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RAILWAY Mechanical and Electrical Engineer

Founded in 1832 as the American Rail-Road Journal.

VOLUME 124 No. 5

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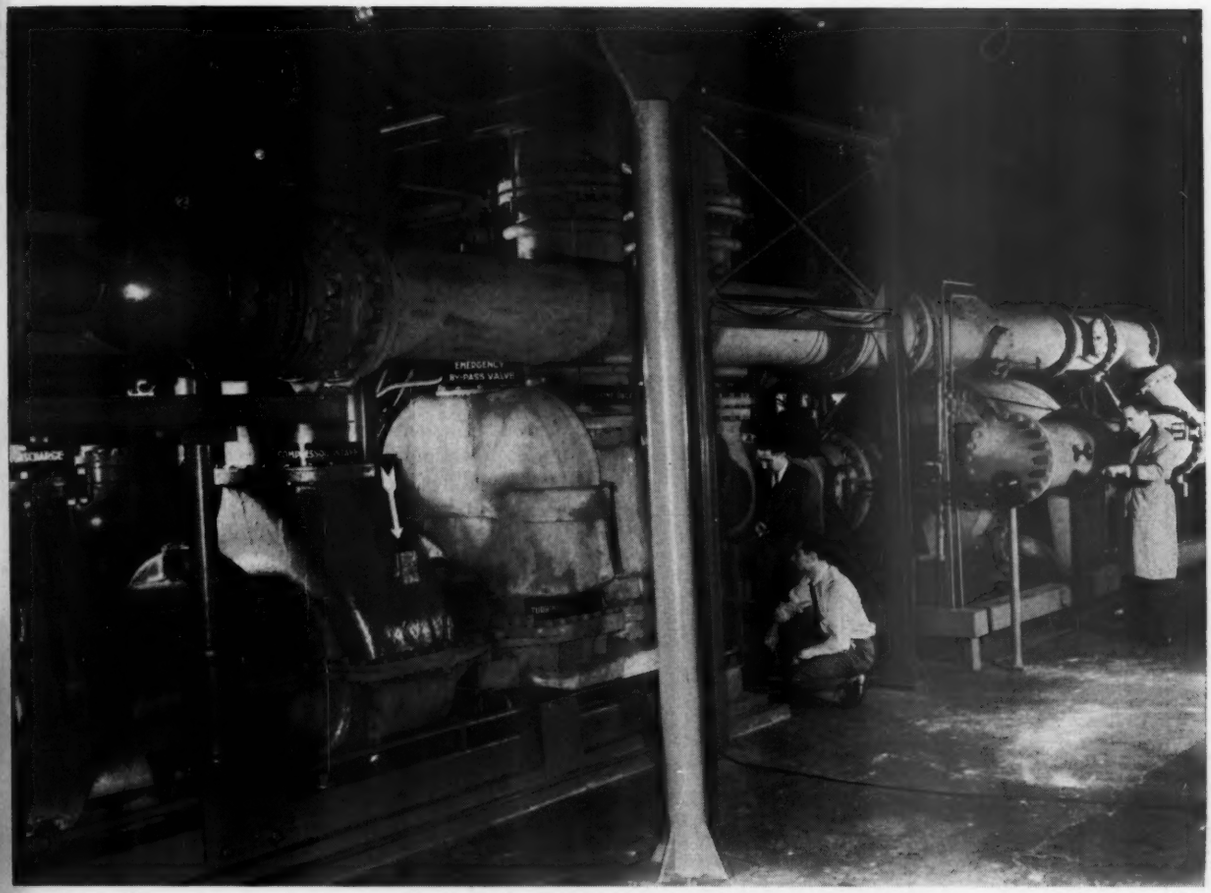


The Allis-Chalmers Houdry process coal-burning gas-turbine installation at Dunkirk, N. Y.—F. D. Buckley, (standing, center) is the manager of this installation

The Gas Turbine at Dunkirk*

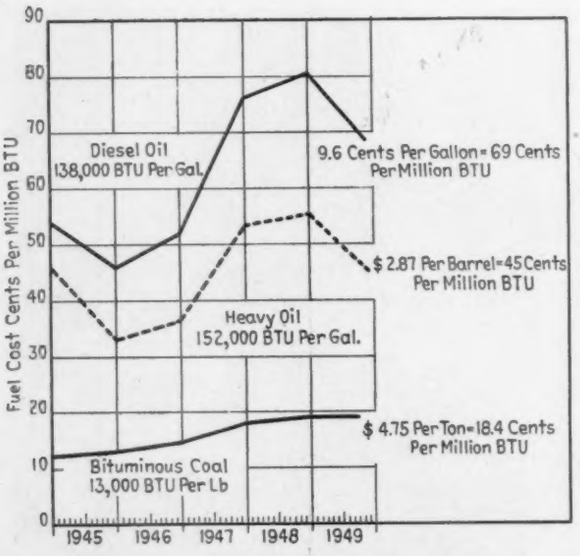
Description of equipment for preparation, feeding, and flow control of the coal; of the ash-separation system, and of the method of turbine temperature control—Components development reviewed

By John I. Yellott†

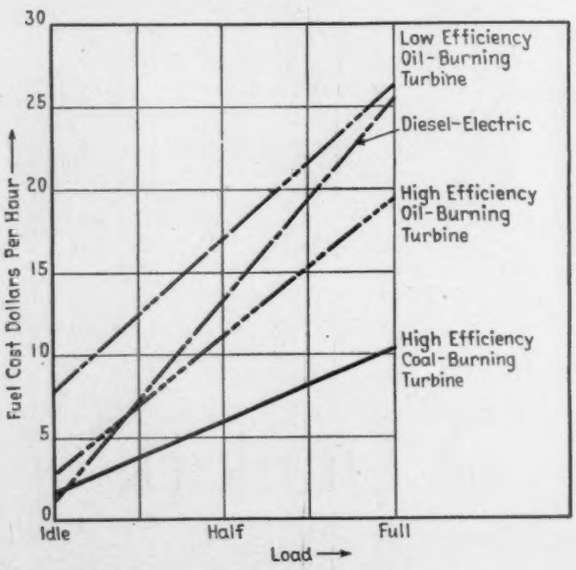
THE Locomotive Development Committee of Bituminous Coal Research, Inc., has for the past five years been concentrating upon the job of making the open-cycle gas turbine burn pulverized coal. The most pressing need for a coal-burning gas-turbine power plant today is in the locomotive field where bituminous coal continues to be the cheapest fuel. Coal's cost per million B.t.u. has risen from 12 cents to approximately 18 cents, while Diesel oil has climbed from 50 cents to a current price of 69 cents per million B.t.u. The cost of residual oil has fluctuated widely, and for the western roads, but not the eastern, it has frequently been cheaper than coal.

* From a paper prepared for presentation before the Midwest Power Conference at Chicago, April 7, 1950.

† Director of Research, Locomotive Development Committee



Average fuel prices reported to I.C.C. by three eastern railroads showing variations since 1945



Variations of fuel cost per hour with the load—4,500-hp. gas-turbine locomotive

The cost of the fuel required to pull a train depends as much upon the thermal efficiency of the locomotive as upon the price of fuel. Coal was formerly cheap enough to compensate for the low efficiency of the steam locomotive, and even today a few roads can show that steam is still their most economical motive power. In most cases, however, the highly efficient Diesel-electric locomotives shows large savings over steam equipment. The gas turbine, because of its ability to use low cost fuels with good efficiency, is a formidable competitor of the Diesel-electric locomotive for road service.

In road service where the average load is 60 to 75 per cent of full power, the coal-burning turbine should save $12 to $15 per hour over the Diesel's fuel cost. An annual fuel saving in the order of $50,000 per locomotive can be expected at present fuel prices. This is the economic justification for the eastern railroads' efforts to develop the coal-burning gas turbine. More broadly, the vastly greater world-wide coal reserves, as compared with oil, give long-range significance to the program of the Locomotive Development Committee.

Small-Scale Component Development

The coal-burning gas-turbine plant which is the subject of this progress report is the result of four years of work, during which all of the necessary components were first tested on a small scale at atmospheric pressure. The program was begun in the spring of 1945 when projects were set up at a number of established research institutions. Simultaneous attacks were made upon the problems of coal handling, combustion, and ash removal.

[The author here described the various research projects, the results of which have led to the present status of the locomotive equipment. These included the study of preparation, pressurizing, pulverizing and combustion on a small scale at Johns Hopkins University; a study of combustion at atmospheric and elevated pressures at Battelle Memorial Institute[1]; a study of the fly-ash problem, methods of improving performance of the coal atomizer, partial gasification of coal, and a study of pressurizing finely crushed coal at the Institute of Gas Technology at Chicago[2]; the effect of sulphur in coal on stainless steel at Purdue University (no measurable effect was found under gas-turbine conditions up to 1,800 deg. F.); Southern Research Institute developed an air-balanced device for determining feed rates from a pulverized coal tank.—Editor.]

By mid 1946 a pilot plant had been installed at the Dunkirk, N. Y., plant of the Alco Products Division, American Locomotive Company, where coal could be burned under pressures as high as 60 lb. per sq. in. gauge at rates up to 1,000 lb. per hour.[3] A larger version of the Johns Hopkins coal system was constructed, using a Standard Stoker piston coal pump to pressurize the coal. Feeding of crushed coal from the pressurized storage tank was accomplished by the use of a variable speed screw. A coal atomizer was used for pulverization. Shop air at rates up to 1,000 lb. per min. was available to burn the coal, cool the combustor, and chill the ash. A battery of small centrifugal separators removed most of the fly ash before the heated air was released through a pressure-reducing valve and allowed to pass through a turbo supercharger to determine the effect of the remaining ash upon high-speed turbine blades.

Operation of the pilot plant disclosed a number of major problems which had not been discovered in small-scale operation at atmospheric pressure. Most

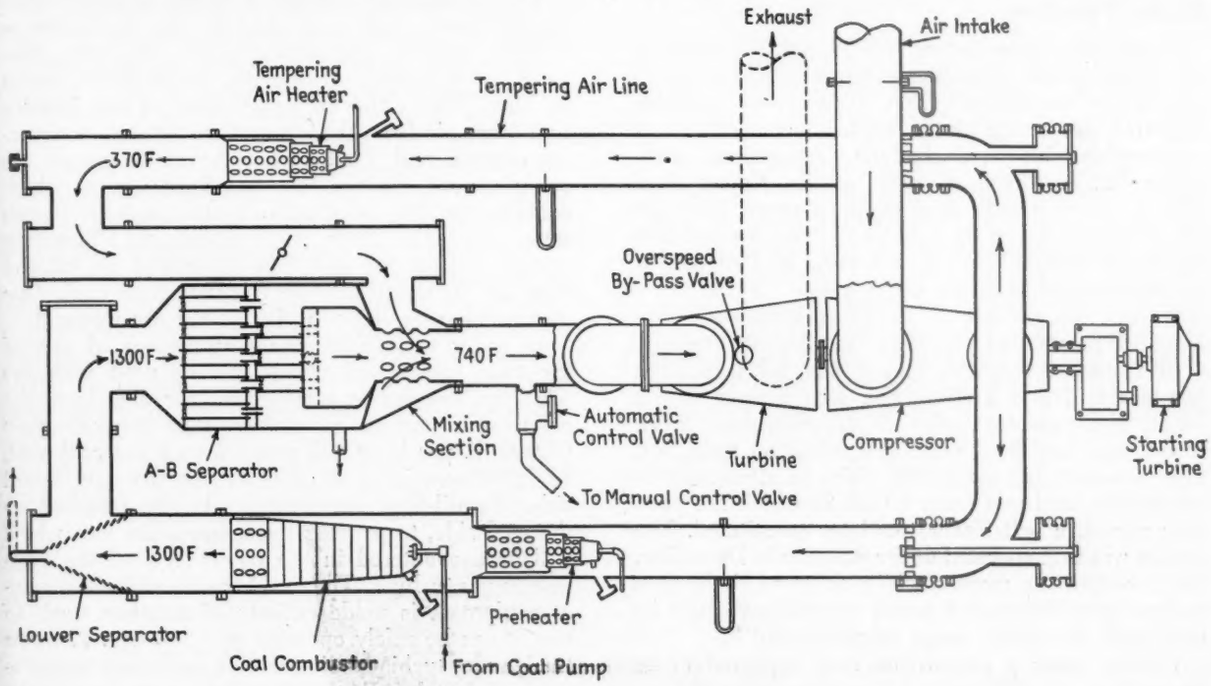
[1] "Experimental Combustion of Pulverized Coal at Atmospheric and Elevated Pressures," by Hazard and Buckley, Transactions of the American Society of Mechanical Engineers, August, 1948. See also "Coal and the Gas-Turbine Locomotive," by Yellott and Kottcamp, before Mechanical Division, A.A.R., June 24, 1947. Abstracted in the June 25, 1947, Daily *Railway Age*, p. 1294D122.

[2] "Studies on Fly-Ash Erosion," Fisher and Davis, Mechanical Engineering, June, 1949, page 481.

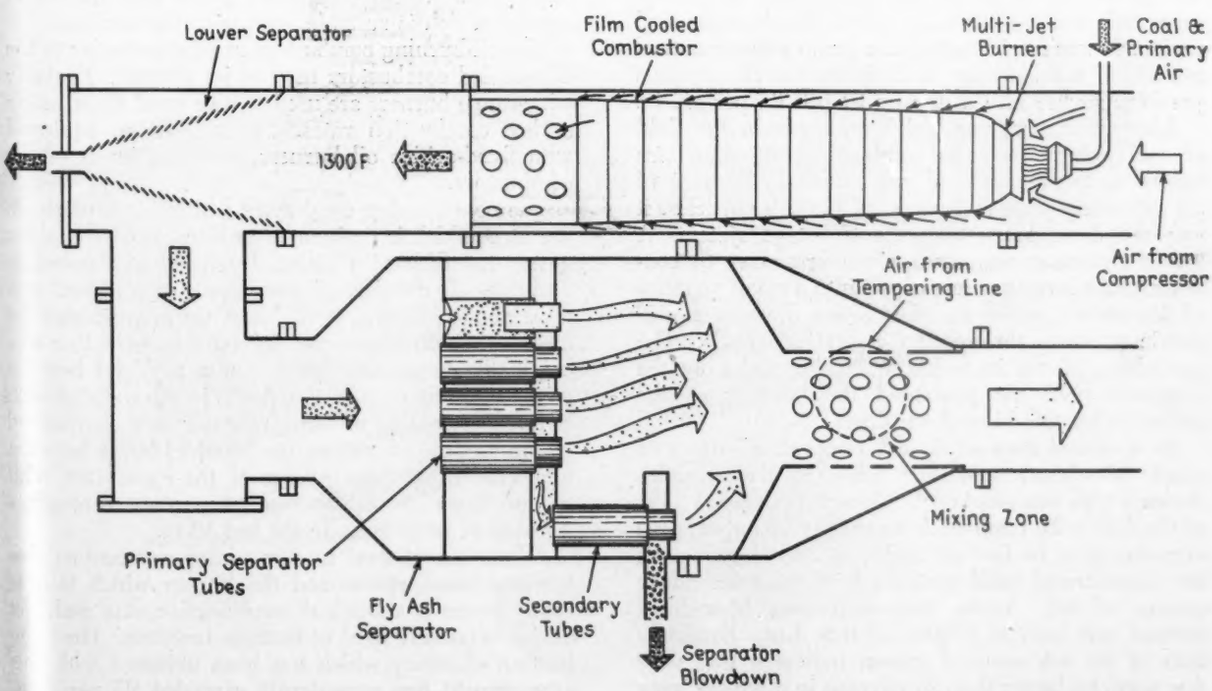
[3] "The Coal-Burning Gas-Turbine Locomotive," by Yellott, Kottcamp and Broadley, 1947 annual meeting, American Society of Mechanical Engineers. Abstracted on page 118 of the March, 1948, *Railway Mechanical Engineer*.

serious was the fact that, with 90 per cent combustion efficiency, the best then obtainable with cold-wall combustors, the carbon remaining in the ash burned vigorously in the fly-ash separators. This disturbing situation caused attention to be turned to a ceramic-wall, slagging combustor, in which efficiency of combustion consistently approached 98 per cent and about half of the ash appeared as slag in lumps of moderate size. The remaining fly ash was sufficiently low in carbon content to be harmless to the fly-ash separators.

The Dunkirk pilot plant is now being dismantled, since the Houdry turbine which is described in this paper has provided greatly superior facilities for full-scale testing. Work is continuing, however, on an atmospheric-pressure, full-scale, horizontal ceramic



Arrangement of the Dunkirk coal-fired Houdry gas-turbine plant



Arrangement of the combustion and ash-separation equipment at the Dunkirk Houdry gas-turbine installation

combustor. For low-ash-fusion and low-volatile coals the ceramic tube shows considerable promise. Such excellent results have been obtained, however, with the all-metal combustor under actual turbine conditions that this type will be used in the first tests of the actual locomotive power plant.

Full-Scale Tests of Components Under Pressure

Small-scale, low-pressure tests showed the necessity of working with full-scale equipment under actual gas-turbine conditions. After a survey of available facilities, this phase of the work was undertaken in conjunction with the Turbodyne Corporation, a subsidiary of Northrop Aircraft, at the Kaiser Steel Mill, Fontana, Calif. At Fontana a spare blast-furnace blower, driven by a steam turbine, gave a firm supply of 100,000 cu. ft. per min. of free air, at pressures up to 25 lb. per sq. in. gauge.

During the summer of 1947 coal-handling equipment of locomotive size was installed at Fontana. Coal from a locomotive stoker was fed through a hammer mill and a slide-valve lock hopper into a large, high-pressure tank. A variable-speed screw feeder was used in the initial combustion tests, but, after encountering many difficulties in attempting to control the feed rate from a tank in which the pressure varied, a belt feeder was later substituted. The system was first operated under pressure in December, 1947, and in the months which followed, it became evident that film-cooled metal combustors could be used with acceptable range, efficiency and life.

Feeding from a pressurized tank appeared to be impractical on a large scale, and, consequently, an attack was made on the problem of continuously pressurizing finely crushed coal. A rotary pump was developed in which extremely close clearances were maintained by the use of a refined mechanical design. It was found that such a pump was a practical means of transferring coal from an atmospheric pressure source into a line up to 140 lb. per sq. in.

After good progress had been made in the field of coal preparation and combustion, attention was turned to the problem of ash removal. Because of the extremely wide size range of the ash particles, it was found necessary to use a two-stage system. A louver separator was used as the first stage to concentrate the large particle of ash into a small quantity of flowing air, which was then blown down to atmospheric pressure through an aspirating nozzle. The quenching of the incandescent ash particles by the aspirated cold air prevented the burning of the separator on this blow-down line.

As a second stage of fly-ash removal, a battery of small cylindrical separator tubes of the straight-through type was employed. These tubes caused most of the dust to be removed from the air by imparting a vigorous spin to the air and dust and drawing off the concentrated solid particles in a small secondary stream of air. Again, the continuous blow-down method was used to dispose of this dust. Extensive tests of the ash removal system indicated that very few particles larger than 20 microns in diameter were getting through the system, and most of these appeared to be agglomerates rather than individual particles. By early spring of 1949 it was concluded that it would be safe to operate a turbine of large size on coal as its primary fuel.

Installation of the Houdry Turbine at Dunkirk

The United States Bureau of Mines, Department of the Interior, made available to the committee a Houdry process gas-turbine plant, originally destined for a Russian oil refinery. Erection was begun in May, 1949. The air compressor of the Houdry unit takes air from the atmosphere through a metering section and a silencer. The discharge of the compressor is divided into two lines, one of which contains the coal combustion system and the fly-ash separators. The other line contains an oil-burning system, so that the unit may be started on oil and then the operation may be transferred to coal. One of the drawings shows a plan of the arrangement.

In order to simulate the performance of one of the twin combustors which will be used with the 4,200-hp. locomotive turbine, the air flow from the compressor can be divided so that approximately 93,000 lb. per hour will pass through the coal side, while the remaining 113,000 lb. pass through the oil side. An oil-fired air preheater is also installed on the coal side, to provide the temperature rise which will be encountered in the regenerator of the locomotive gas turbine. The coal-burning and ash-removal equipment is made entirely of stainless steel, so that it can be safely operated at 1,300 deg. F. Since the Houdry turbine is limited to a maximum temperature of 1,000 deg. F., the air which comes through the oil side of the system is introduced at the outlet of the fly-ash separation apparatus, thus reducing the 1,300 deg. F. coal combustor outlet temperature to a value which is suitable for use in the turbine.

The oil-burning combustors are quite similar to the film-cooled combustors used in jet aircraft. Peabody wide-range burners are used to give good atomization at low combustion rates. Spark igniters, equipped with fixed-orifice oil burners, are used in all of the combustors.

The coal-burning combustor which is currently in use at Dunkirk is designated as Fontana No. 5, since it was the fifth of a series developed and tested at Fontana. It consists of telescoping cylindrical sections of the stainless steel, ⅛ in. thick, supported by means of external girders. A riveted construction was originally employed, but this was replaced because of the building up of ash deposits in the wake of each rivet. The cooling of the combustor is accomplished by admission of air at the slots existing between adjacent rings. The mixing of the excess air with the products of combustion takes place through a number of large holes in the last 30 in.

Admission of coal to film-cooled combustors has received much study, and the burner which is currently in use is a Dunkirk modification of a multi-jet device originally used at Battelle Institute. The combustion efficiency which has been obtained with this arrangement has consistently exceeded 95 per cent. Coal has been burned in this combustor at rates up

to 1,800 lb. per hour. After a continuous test of 32 hours, the combustor was found to be relatively clean and completely undistorted.

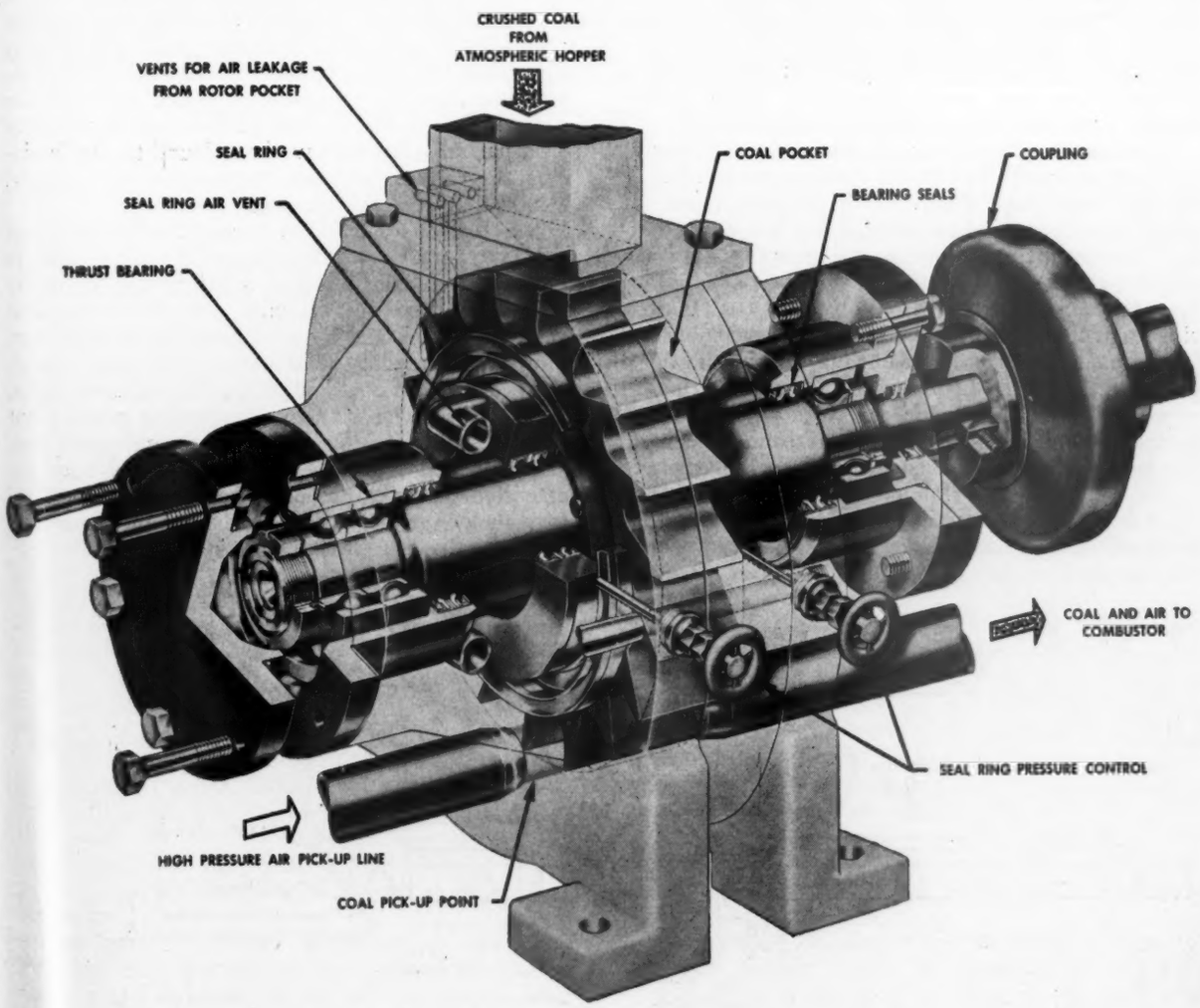
Development is now going forward to improve the range of this type of combustor, so that the gas turbine can be operated on coal without the need of an oil pilot flame.

The louver separator which forms the first stage of the ash-removal equipment was also built by Turbodyne and originally tested at Fontana. This louver was designed from data made available by the American Air Filter Company of Louisville, Ky., and it has withstood several hundred hours of operation without any visible deterioration. It removes approximately 50 per cent of the solids contained in the combustion products, and it also serves most effectively as a means of eliminating stratification in the heated air leaving the combustor.

Final removal of the fly ash is accomplished by a battery of 18 American Blower Type ST separators. The general arrangement of this apparatus is shown in a drawing. Approximately 90 per cent of the 20,000 cu. ft. per min. which comes from the combustor passes directly through the tubes, transferring most of the remaining dust into approximately 10 per cent of the air stream which passes through the secondary tubes. This dust is concentrated again into approximately one per cent of the original air stream, which is then blown down through a small nozzle. The remaining 9 per cent can then be readmitted to the main stream to the turbine.

The mixing of the relatively cool air from the oil-heater side with the 1,300 deg. F. from the coal-burning equipment is accomplished by a mixing zone which is virtually the same as the cooling section at the end of the combustor. This device, designed by the Battelle combustion group, has functioned satisfactorily.

At a firing rate of 1,800 lb. of coal per hour, the heat release is approximately 750,000 B.t.u. per hour per cu. ft., or 6,000,000 B.t.u. per hour per sq. ft. of cross-section area. Under these conditions, the combustor runs relatively cool and clean. There has been very little slagging in the combustor, and virtually all of the ash appears as a fine dry powder suspended in the combustion products. Building up of ash on the combustor wall takes place only where the airflow is interrupted by some protrusion, such as a rivet.



The horizontal-shaft blow-through coal pump by which the pulverized coal is pressurized

Coal Preparation Equipment

The coal for the Houdry gas-turbine plant is provided by an Iron Fireman stoker which supplies coal in minus 2-in. lumps to a Whiting high-speed impact mill which includes a fan and a classifier. The fine coal, 97 per cent-100 mesh, flows with the conveying air upward through an 8-in. pipe into a coal separator located in the top of the pulverized-coal storage tank. This separator is a combination of two American Blower Type ST with 361 tubes, and a louver. The cleaned air is returned to the pulverizer. The vented air, which is always required in a closed circuit system such as this, is the secondary flow from the American Blower tubes. Make-up air is provided through an opening at the inlet of the pulverizer. The level of coal in the tank is controlled by a single Fuller rotary level indicator located just below the coal separator. This controller starts and stops the motor on the pulverizer feeder. The stoker operates in response to a level control on a small hopper from which the pulverizer feeder takes its supply.

Feeding of the coal is accomplished by means of a variable-speed drum feeder. It was found after the first tests of this set-up that the pulverized coal in the storage tank was highly aerated, and its bulk density was as low as 20 lb. per cu. ft. Likewise, this coal is fluidized to such an extent that it will flow very readily through even the smallest crevices. Some difficulty has been encountered from leaks in the feeder, a problem still undergoing vigorous study.

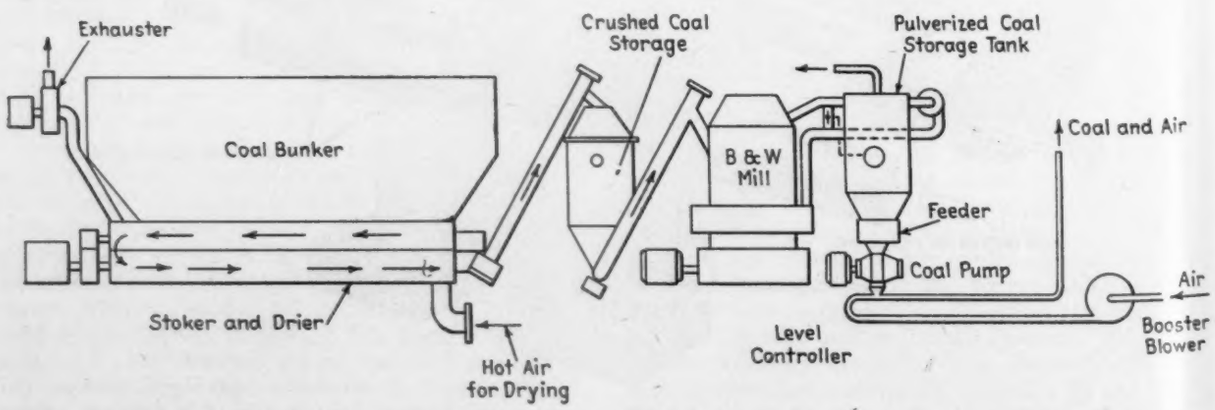
Continuous pressurizing of the coal at whatever rate may be established by the feeder is accomplished by the rotary coal pump. Two different types of pump have been tried extensively, but it appears that the blow-through feature of the pump illustrated, which was developed by the Turbodyne Corporation at Fontana, is essential. The pulverized coal is carried from the bottom of the pump to the combustor by means of compressed air flowing in a 1¼-in. line. The throttle for the plant is, therefore, the variable-speed drive on the coal feeder. The pulsations expected to result from operation of the drum feeder and the coal pump have proved to be of no importance.

The speed of the Houdry unit (rated at 5,180 r.p.m.) is the primary variable, and the operator keeps this as a predetermined value by adjusting the fuel flow. The only load on the machine is constituted by the air which is blown down from the fly-ash separation equipment, and an additional quantity of air which is discharged through the control valve. Normally, speed remains constant, despite variations in combustor outlet temperatures of 25 deg. above and below the mean value.

Future Work with the Houdry Unit

The Houdry unit was installed for the dual purpose of demonstrating that coal can be successfully used as a fuel for a full-scale gas turbine and as a research installation to permit development of improved coal-handling, combustion, and fly-ash removal equipment. At the present time it is being operated as many hours as possible each week to determine the effect of the unremoved fine dust upon the blades of the turbine. After the first 150 hours of operation, inspection of the last row of blades, made by entering the turbine through the exhaust duct, indicates no damage whatsoever. A very thin layer of fine dust adheres to the blades, but there is no evidence of any impairment of the turbine performance. It is realized that the Houdry turbine is operating at a temperature much lower than a power generating gas turbine, and it will not be safe to conclude that the problems of ash removal are solved satisfactorily until a full-scale, full-temperature gas turbine has been operated on pulverized coal for thousands of hours. However, the performance of the Houdry turbine indicates that at least partial solutions have been found to the fundamental problems of coal preparation and supply, combustion, and ash removal.

It is the intention of the Locomotive Development Committee to push the project to completion as rapidly as possible. The first experimental locomotive will be composed of two units, with the power plant mounted on one and the coal preparation equipment shown in a drawing, on the other. Six-wheel trucks, identical to those used in 2,000-hp. Diesel locomotives, will be used. The 4,200-hp. gas-turbine power plant manufactured by Allis-Chalmers has undergone preliminary tests. It will be moved to Dunkirk soon for extensive stationary tests. If these tests are satisfactory, the power plant will be installed in a locomotive and extensive road tests undertaken.



The coal-supply system which will be installed on the Locomotive Development Committee's gas-turbine locomotive

Loading pulpwood for Great Northern Paper Company's mills at Sheridan, Me.

Handling Pulpwood In Special Cars

An excellent example of coordinated effort on the part of a railroad, a shipper and a manufacturer with the objective of finding methods to lower the cost of handling commodities is the evolution of pulpwood car design and the development of a special car dumper worked out by joint efforts of the Bangor & Aroostook, the Great Northern Paper Co. and the Magor Car Corporation.

A substantial portion (about 20 per cent) of the freight traffic of the Bangor & Aroostook is pulpwood, 818,661 tons having been handled during 1947 and 710,335 tons during 1948. Most of it moves from loading points in the Northern Maine woods to paper mills such as the one at Millinocket, Maine.

Until about 1947 the pulpwood to the Great Northern mills was loaded in box, gondola, rack or flat cars and unloaded at the mill by manual labor requiring about 2½ man-hours to unload an average car of 19 cords.

During 1945 the first of an experimental design of side-discharge pulpwood cars was worked out and the car built by the Bangor & Aroostook.

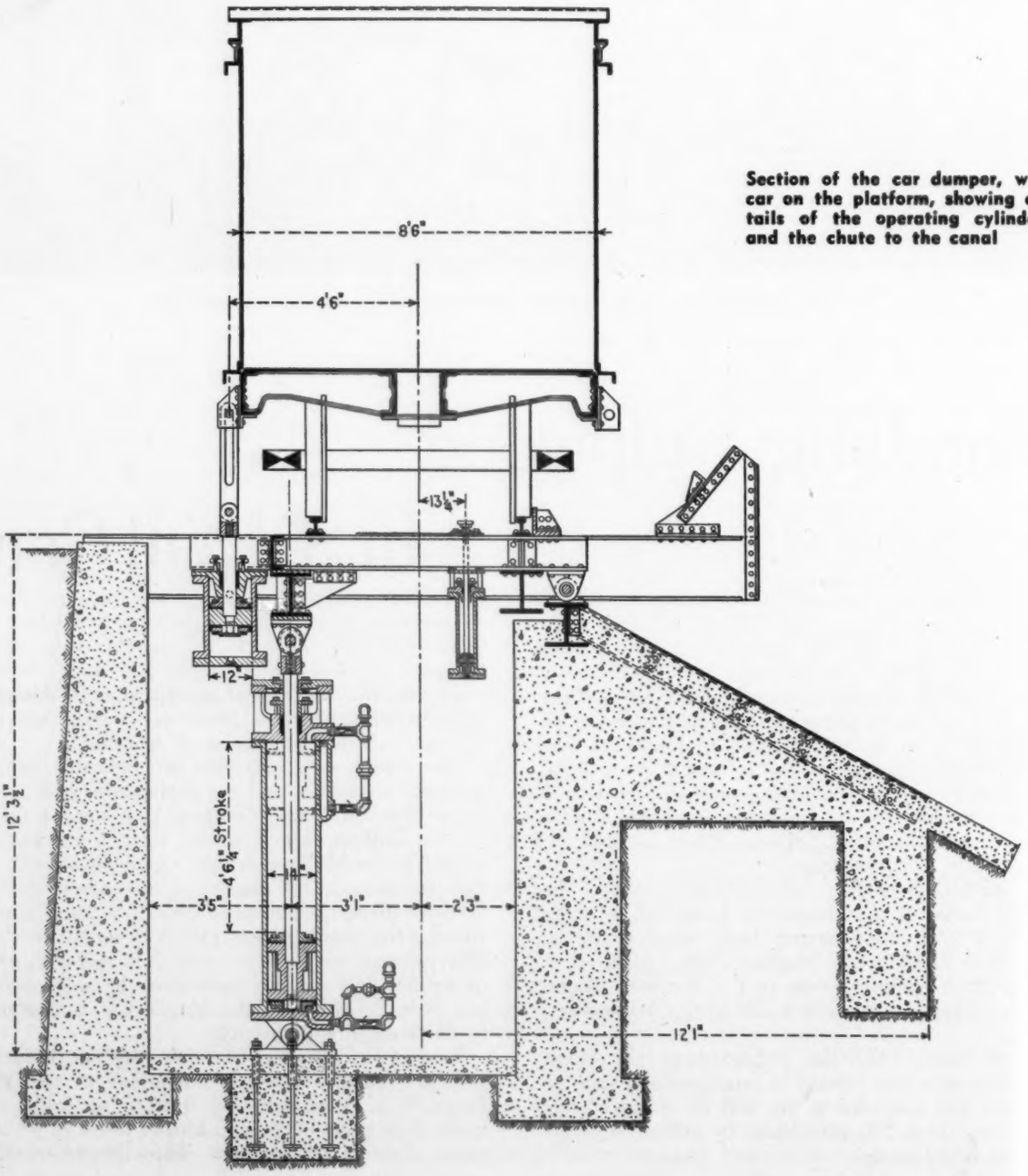
The initial tests with this car indicated definite potential economies and the engineering staff of the Great Northern Paper Company developed a design of car dumper which in its final form was installed at the Millinocket mill. Coincident with the dumper project, the Bangor & Aroostook ordered 100 side-discharge pulpwood cars of 50-tons capacity which were completed and placed in service in 1947. They proved satisfactory and a subsequent order of another 100 cars, of essentially the same design, has been delivered by the Magor Car Corporation to the Bangor & Aroostook.

Two of the drawings show the general design of the car dumper, which is comprised of two platforms 8 ft. 6 in. long by 9 ft. 5 in. wide, one under each truck of the car, hinged to tilt to a maximum angle of 39 degrees. These platforms, with

the car are controlled in their movement by hydraulic cylinders of 14-in. bore by 54¼-in. stroke exerting a force of 64,600 lb. with 420 lb. per sq. in. hydraulic pressure from a common source.

The pulpwood car is run onto the tilting platforms of the dumper, uncoupled, and held to the rails by locking bars attached to lugs on the side of the car with $2\frac{7}{16}$-in. pins. The locking bars are hinged to jaws on the ends of the pistons of two 12-in. hydraulic holding-down cylinders secured to the dumper platforms. At 270-lb. per sq. in. hydraulic pressure the resistance to the overturning of the car is 27,250 lb. at each cylinder.

Once the car is locked to the platform rails another hydraulic cylinder of 6-in. bore and 15-in. stroke actuates the locking mechanism of the side-discharge car doors to unlock the doors, the pressure is applied to the 14-in. jacking cylinders and the dumper platforms and the cars are tilted. Structural brackets on the dumper platform are located in such positions as to permit the side sills of the car to rest on heavy angle supports when the platforms are tilted to the maximum angle in the dumping position. In this position the contents of the car slide out onto a steel plate and concrete deck with a slope of 6 in. in 12 in. from which the pieces of

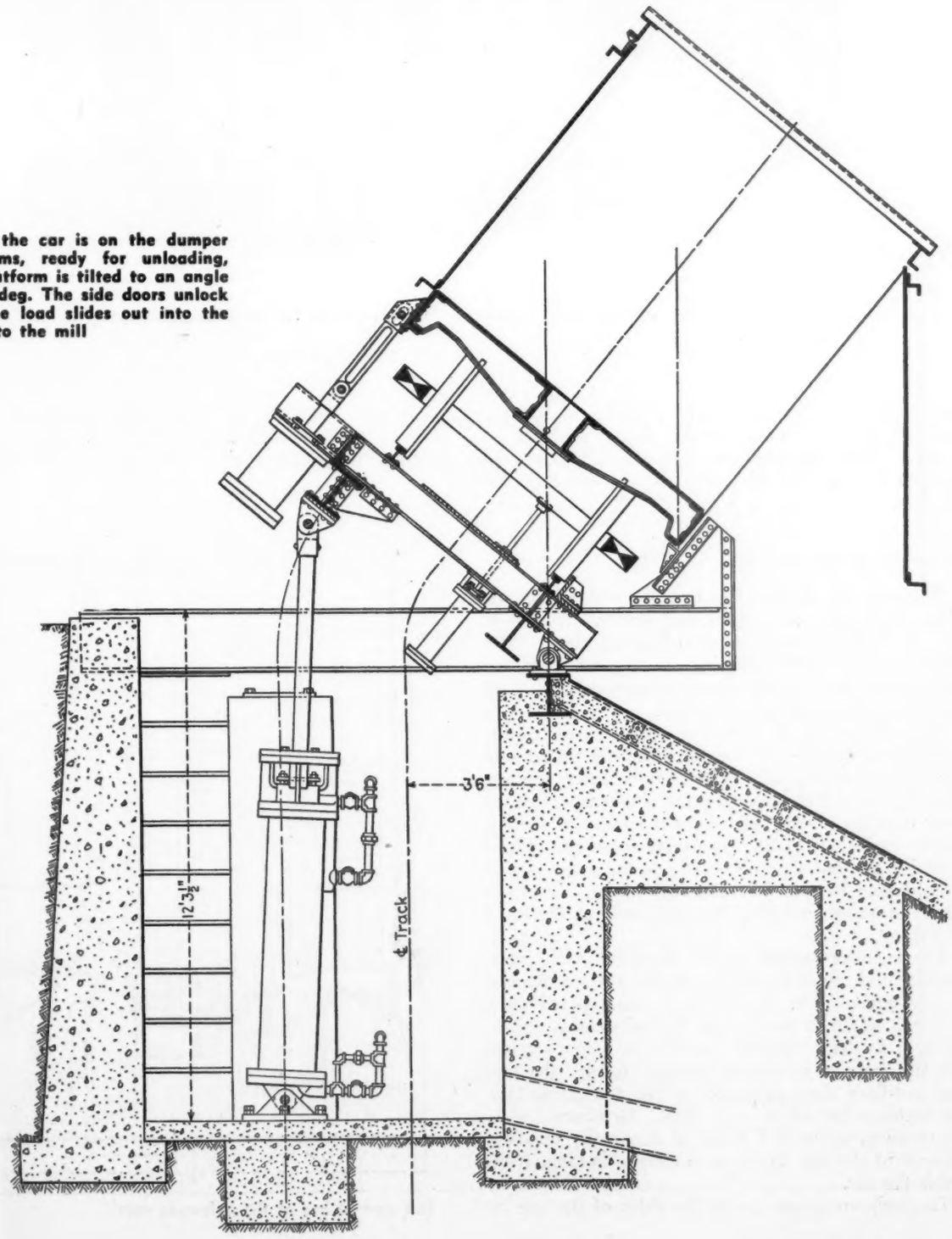


Section of the car dumper, with car on the platform, showing details of the operating cylinders and the chute to the canal

pulpwood roll into the canal leading to the mill.

The hydraulic pressure is supplied by two motor-driven gear pumps, one of 17½-g.p.m. capacity for the holding down cylinders and another of 80-g.p.m. capacity for the jacking cylinders. Valves in a pump house adjacent to the dump serve to control all three sets of cylinders.

After the load has been dumped the movement of the jacking cylinder pistons is reversed by the application of pressure to the stuffing box end of the cylinder which forces the oil from the opposite side of the piston through a ⅜-in. orifice to the return pipe lines thus lowering the platform slowly, under control, to the horizontal position where the pressure is released from the holding-down cylinders and the locking bars removed. The side car doors



When the car is on the dumper platforms, ready for unloading, the platform is tilted to an angle of 39 deg. The side doors unlock and the load slides out into the canal to the mill

Bangor & Aroostook car built by Magor Car Corporation for handling pulpwood

are closed after the door trip cylinder is lowered and the doors secured in the closed position by latches. The complete operation of setting and unloading the car can be performed in less than ten minutes.

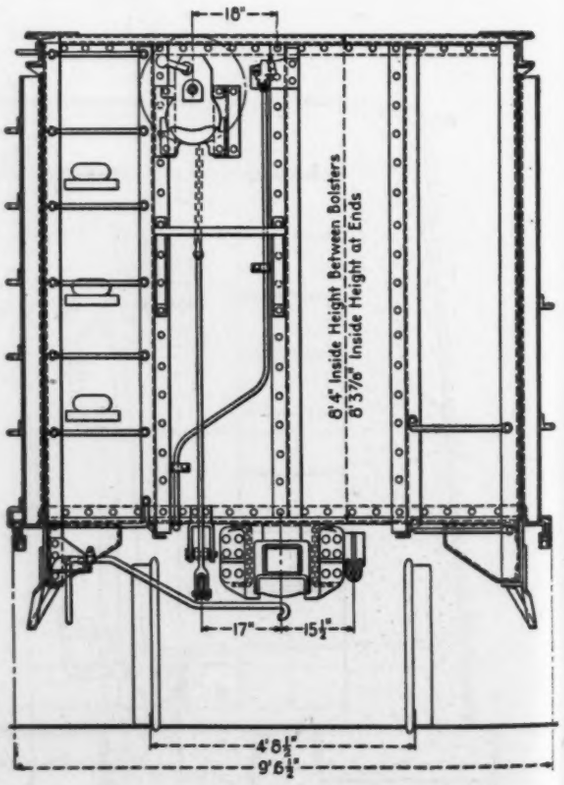
Description of the Cars

The cars are of open hearth steel, with all shapes, plates and bars ¼-in. thick and under. All sheets are of 0.20 per cent copper bearing steel. The construction is principally by riveting, with welding being used for miscellaneous sub-assemblies. All interior rivet heads are flattened.

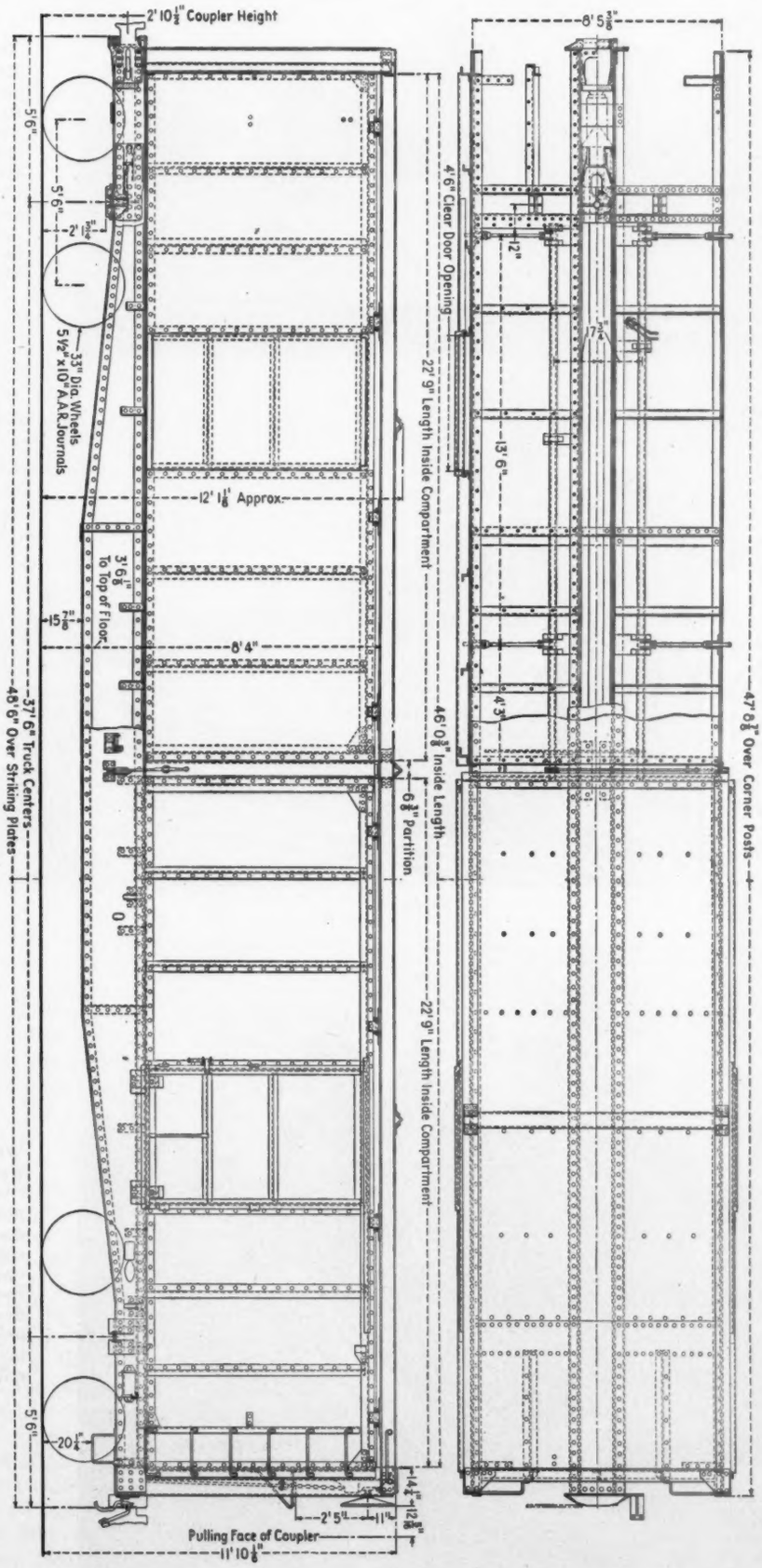
Since the entire sides of these cars are doors, the underframe carries the load on fish-belly center and side sills of approximately the same center depth—2 ft. 2¼ in. All chord angles are single except at the bottom of the center sill, where the inner and outer chord angles are used. Bolsters, crossbearers and crossties are full flanged pressings, the bolsters and crossbearers having bottom cover plates. There is one continuous end sill, the end itself acting as a lateral tie.

The ends are single inside sheathed, with intermediate and center zee stiffeners and pressed channel corner posts. The corner posts are tapered to a sufficient width at the bottom for substantial attachment to the side sill, the outer edge being vertical and the inner edge sloping outward toward the top. The end floor sheet is flanged across the car to take the bottom edge of the end sheet. Reinforced slots are punched in the end sheets at diagonally opposite corners of the car to serve as escape ladders from inside the car.

The ends are connected at the sides of the car by continuous rolled zee side plate members which carry the sides. These side plates are supported and spaced across car at the center by a double sheathed,

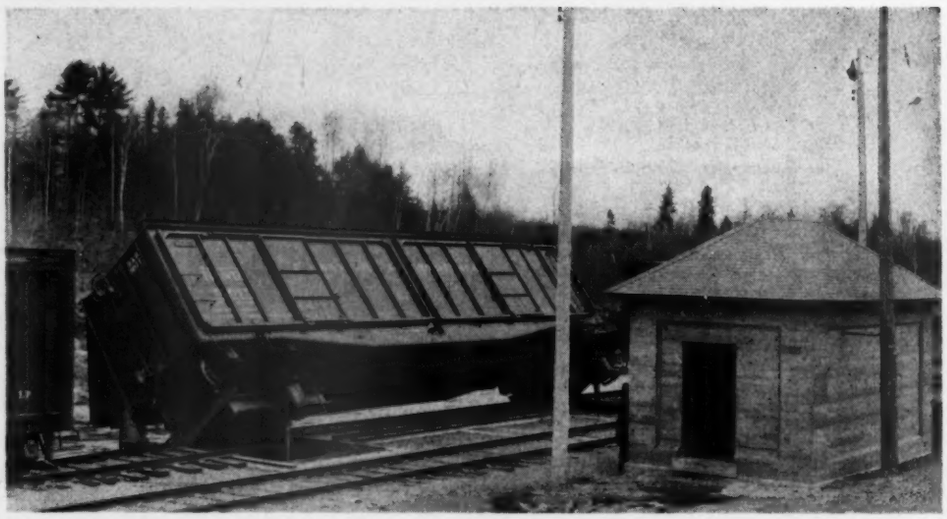


End view of one of the pulpwood cars

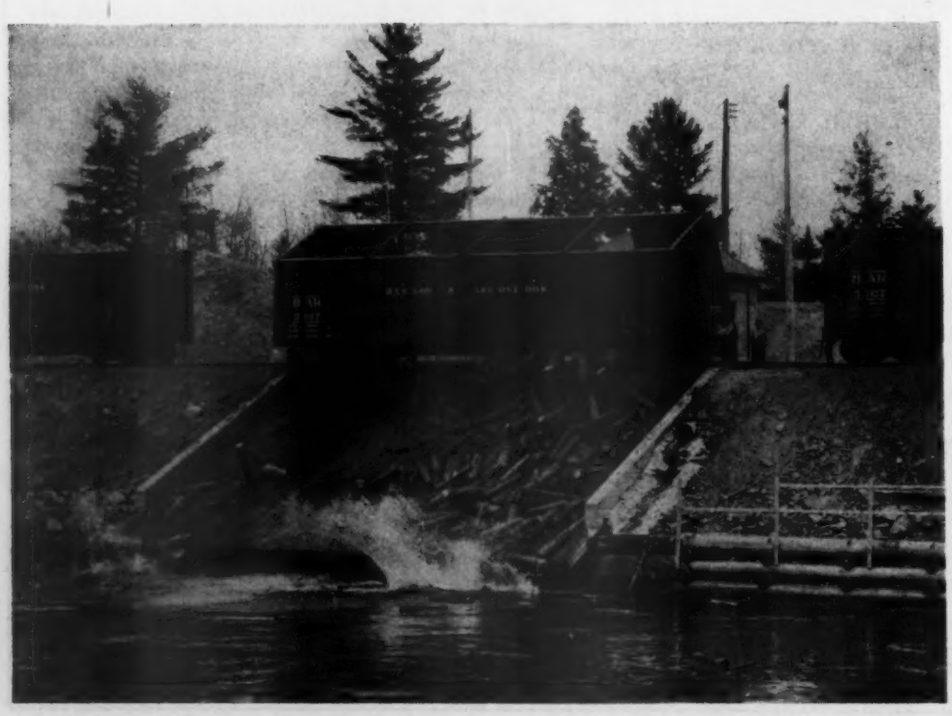


Side elevation and plans of the Bangor & Aroostook pulpwood car

The cars are lined up over the dumper by an internal-combustion small switching locomotive. This illustration shows the chute down which the pulpwood rolls into the canal



The dumper platform, with a car in the tilted position. In the immediate foreground is the pump house which contains the motor driven pumps and the controls



When the pulpwood cars are tilted on the platform of the dumper the sides of the car open and the contents slide down the apron into the canal leading to the mills

full partition. Two additional spacers are placed between the side plates half-way between partition and ends of car.

Each side is made up of two swinging doors, hinged on the side plate, and extending from center partition to the end of the car. Each swinging door is carried on four cast steel hinges, and carries two pocketed castings at bottom, or closing edge, which when the door is closed, nest over male castings welded to the side sill. These nested castings resist longitudinal motion of doors due to draft or buff. Doors are held in a closed position by latch hooks which work against flanges on the nesting castings.

Each swinging door carries abuilt-in sliding door with bottom rollers, covering a 4 ft. 6 in. door opening. The sliding doors can be opened by a pinch bar working in a series of holes in the bottom member of swinging door in case they are jammed by the lading.

The operation of swinging door latch hooks can be accomplished either manually or automatically. Hooks are connected by adjustable links to levers on rotating shafts, one shaft on each side of center sill. Each shaft is continuous, operating all latches on the side of the car which it controls. In automatic operation, on the dumper, a plunger working against a return spring, is pushed up by a tripping device. This plunger rotates one of the shafts, thus releasing both doors on one side of the car. Since there are two plungers under the car, each operating doors on only one side, dumping is selective as to direction, so that cars may still operate on the one-direction dumper regardless of being turned in handling. For manual operation, each shaft can be rotated by a linkage from a lever which is normally locked in a vertical position against the end of the center partition. There are two such levers, one on each side of the car. As a safety measure, each lever releases only the door on the opposite side of car so that lading cannot be dumped on the operator.

Combination jacking pads and hold-down brackets are located at each end of each bolster. Hold-down brackets are engaged by a removable pin to restraining mechanisms built into the car dumper, thus locking car to the rails during unloading. The trucks are unit type with cast steel bolsters and double-truss frames, A. A. R. D-2 spring group with top and bottom plates, chilled wheels, and roller side bearings.

Safety devices meet with I. C. C. requirements, and include side and end ladders. Since swing doors extend full length of car, the side ladders are perforce attached to the swing door with the exception of the top grab, which is on the side plate. Roping staples are applied at the bottom of each side sill, near the center of the car.

The brakes are of conventional AB type, with truck connections passing through the bolster. The cars are braked at approximately 20 per cent of the gross rail load of 169,000 lb., based on 50-lb. pressure in a 10-in. by 12-in. brake cylinder. The train line and retainer line are welded to diaphragms through which they pass.

The car as the load is about to be dumped

PARTIAL LIST OF SPECIALTIES ON BANGOR & AROOSTOOK PULPWOOD CARS

Couplers	Symington-Gould Corp., Rochester, N. Y.
Yokes	Symington-Gould Corp., Rochester, N. Y.
Truck frames and bolsters	Symington-Gould Corp., Rochester, N. Y.
Journal box lids	Symington-Gould Corp., Rochester, N. Y.
Center filler	Symington-Gould Corp., Rochester, N. Y.
Coupler release rigging	Standard Railway Equipment Manufacturing Co., Hammond, Ind.
Draft gear	W. H. Miner, Inc., Chicago
Draft key retainer	Illinois Railway Equipment Co., Chicago
Brakes, Air	Westinghouse Air Brake Co., Wilmerding, Pa.
Brake regulator	Royal Railway Improvements Corp., Wilmington, Del.
Hand brake	Universal Railway Devices Co., Chicago
Brake jaws	Schaefer Equipment Corp., Pittsburgh, Pa.
Truck levers	Schaefer Equipment Corp., Pittsburgh, Pa.
Truck connection	Schaefer Equipment Corp., Pittsburgh, Pa.
Brake beams	Buffalo Brake Beam Co., New York
Brake shoe keys	Buffalo Brake Beam Co., New York
Brake, Truck, arrangmeent	Unit Truck Corp., New York
Journal bearings	Magnus Metal Corp., New York
Dust guards	Ajax-Consolidated Co., Chicago
Brake shoes	American Brake Shoe Co., New York
Truck springs and plates	Union Spring and Manufacturing Co., New Kensington, Pa.
Wheels	Griffin Wheel Co., Chicago
Side bearings	A. Stucki Co., Pittsburgh, Pa.
Brake step	Apex Railway Products Co., Chicago
Defect card holders	Western Railway Equipment Co., St. Louis, Mo.

PRINCIPAL DIMENSIONS AND WEIGHTS OF BANGOR & AROOSTOOK PULPWOOD CARS

Length over strikers, ft.-in.	48—6
Lenth of truck centers, ft.-in.	37—6
Lenth inside at end plate, ft.-in.	46—6⅞
Length inside at floor, ft.-in.	44—6⅞
Length inside compartment, ft.-in.	22—9
Thickness of center partition, ft.-in.	0—6⅜
Width, maximum (at sliding door roller pins) ft.-in.	9—9⅞
Width over side sills, ft-in.	8—6¾
Width inside, ft.-in.	8—7¼
Height over all from rail, ft.-in.	11—0
Height, rail to top of floor, ft.-in.	3—6⅛
Height inside to top of side and end plates, ft.-in.	8—3⅜
Wheel diameter, in.	0—33
Journal size, in.	5½ by 10
Coupler height, ft.-in.	2—10½
Light weight, lb.	56,000
Loaded weight, lb.	169,000
Load capacity, lb.	113,000
Capacity, cu. ft.	3,206
Truck centers, ft.-in.	37—6
Truck wheel base, ft.-in.	5—6
Clear door opening, ft.-in.	4—6

Corrosion of Diesel Cylinder Liners*

By F. N. Speller† and F. L. La Que‡

During the past few years the authors have encountered individually a peculiar form of corrosion[1] that occurs on the water side of diesel engine cylinder liners.

It appeared first on liners in tractor engines, and particularly in engines of a certain model. Other models of the same make in which the same cast iron was used for liners and which were operated in the same territories with the same cooling water at the same operating temperatures remained free from the peculiar attack. Furthermore, the attack could be reproduced in the engine laboratory using single cylinder test engines—but again only with cylinders which represented the model which was suffering the damage in the field. Likewise, typical attack to a depth of 1/16 inch in three weeks was developed in laboratory tests with a complete full size engine such as used on river barge service.

The next occurrences investigated were in very large Diesels on ocean-going ships. Subsequently, the same type of attack was observed in railroad Diesels, in Diesels used to tow barges on inland waterways, and in truck Diesels operating on the highways. Similar attack has been reported on cylinders of gas engines used in pumping or compressor stations on cross country gas pipe lines.

The nature of the attack is shown in the illustrations. It is characterized by the following features:

(1)—The corroded metal has a honeycombed appearance.
(2)—The corroded surfaces remain substantially free of corrosion products.
(3)—The attack occurs in sharply defined areas with the

Scavenging side — Exhaust Side

Fig. 1—Water-side erosion of Diesel engine-cylinder liner after service for six months bore of cylinder 20½ in.

* Abstract of a paper presented before the National Association of Corrosion Engineers, Hotel Jefferson, St. Louis, Mo., April 5, 1950.

† Corrosion Consultant, Pittsburgh, Pa.

‡ In charge—Corrosion Engineering Section, Development and Research Division, International Nickel Company, Inc., New York.

[1] Corrosion occurs also as a major factor in cylinder wear on the piston side, but this cause of cylinder deterioration will not be considered in this paper. Those interested should refer to C. G. Williams and W. M. Duff—J. Inst. Automobile Engineers (London), June 1933, pp. 73-92.

boundary between the affected and unaffected metal being very sharp and abrupt, though usually irregular in outline.

(4)—The center lines of the areas of greatest attack are characteristically 90 deg. from the center line of the crankshaft. Attack on one side is usually more severe than on the other. Occasionally, there is faint attack of the same nature in the fore and aft quadrants in line with the crankshaft. Frequently, attack is much deeper towards the bottom—the looser end of the liner, and is often absent in the center portion but may appear to lesser degree near the top, as shown in Fig. 1.

(5)—The location of this particular kind of attack does not seem to be determined to any primary extent by the location of the water inlet and outlet passages, nor by so-called "hot spots." However, there have been instances of cylinder liner erosion that have been connected with the location of water passages and regions of unusually high velocity and turbulence and which have been eliminated, or reduced, by improvements in the water flow arrangements.

(6)—The rate of attack has been amazingly high, e. g. 5/16 in. in 900 hours which is equivalent to about 3 in. per year.

(7)—This peculiar attack is not confined to any one design or make of engine. It may appear in only a few engines of a particular type and sometimes in only certain cylinders of one engine.

This evidence that the peculiar attack shown in Figs. 1 and 2 is not ordinary corrosion made the similarity of the form of attack to that observed in certain types of cavitation-erosion tests especially significant.

One method of studying the resistance of materials to cavitation-erosion is to attach test specimens to a vertical carrier partially immersed in a test liquid. The specimen carrier is a nickel tube which forms the core of a high frequency magnetic circuit. Nickel has the property of changing its length when magnetized so that acting as the core of the magnetic circuit it develops a high frequency longitudinal vibration. The magnetic circuit is tuned to the natural frequency of the test assembly and may be of the order of 6,000-9,000 cycles per second. The attached test specimen also, of course, vibrates at the same frequency through an amplitude of the order of 0.003 inch.

One of the results of this high frequency vibration is to cause cavitation in the test liquid and cavitation-erosion of the surface of the test specimen due to the collapse of the 'vacuum' bubbles on the vibrating surface.

There is similarity between the attack on cast iron specimens in this type of vibratory cavitation-erosion test and the attack that sometimes occurs on the water side of Diesel engine cylinder liners.

Since this sort of attack can be made to occur readily on cast iron by causing it to vibrate in contact with water, it is reasonable to assume that when what appears to be an identical form of attack has occurred on cast iron Diesel liners in contact with water, vibration of the liners may reasonably have been a major factor in the occurrence. This assumption is supported further by surveys of vibration in engines that have suffered this type of liner attack. In spite of the difficulties in making a proper study of the vibration of the critical surfaces, a considerable amount of high frequency vibration of the liners has been detected with observed frequencies of the order of 1,500 cycles per second.

A major difference between the attack that occurs in the laboratory vibratory cavitation-erosion testing apparatus and that which occurs in engines is the rate of attack. The attack on one specimen occurred in 90 min., while that of another cylinder liner required several hundred hours.

Cavitation-erosion is a complex phenomenon which includes simple mechanical damage from the pounding effects of the collapsing vacuum bubbles plus chemical or electrochemical action of the liquid involved. Some consider the mechanical effect to be all important, while others believe that the action is principally chemical or electrochemical, with the principal effects of the mechanical action being to prevent any protection film formation or polarization of the corroding surfaces, thus maintaining attack at an extremely high initial or instantaneous rate. The truth probably is between these extreme points of view, with either mechanical or corrosion effects predominating, depending on the severity of the cavitation effects, as reflected in the time in which the action occurs, the nature of the material and the corrosivity of the environment.

That ordinary electrochemical corrosion is not necessary is demonstrated by the occurrence of cavitation-erosion on non-metals like glass. That mechanical effects are not always of controlling importance is shown by the extent to which cavitation-erosion can be suppressed by the application of cathodic protection to test specimens, and by the generally superior performance of corrosion resisting metals and alloys.

As indicated previously, the commonly used laboratory vibratory cavitation-erosion test method tends to accentuate the mechanical factors relative to the corrosion factors—as indicated by the fact that so much damage is accomplished in such a short period of time. It is not surprising, therefore, that the laboratory test method does not more definitely disclose effects of variations in the corrosion resistance of the materials tested nor differences in the corrosivity of the test liquids. This latter point was illustrated particularly well by the recent work of Rheingans[2] who reported no more cavitation-erosion of steel by sulfuric acid than by ordinary water in his vibratory cavitation-erosion testing apparatus. Nevertheless, these accelerated test methods regularly show considerable value of high resistance to corrosion by rating corrosion resisting metals and alloys above ordinary iron or steel having equal or better mechanical properties. They thus point at least indirectly to the role of corrosion in cavitation-erosion.

From the practical standpoint, the fact that corrosion is a major factor is very important. Since, in many cases, it is easier to do something about corrosion than to improve the mechanical factors—eg. as by eliminating or reducing vibration.

In the case of the Diesel liner problem of cavitation-erosion which the authors feel can be described properly as such, there are two avenues of attack from the standpoint of corrosion.

The most common approach has been to reduce the corrosivity of the cooling water by control of alkalinity and the addition of chromate inhibitors. This practice was described by Hansen[3] who has

reported this trouble to be under control by *carefully* maintained chromate treatment in railroad Diesels. The effectiveness of chromate inhibitors suggests that corrosion frequently, if not always, predominates over mechanical forces in the cavitation-erosion of Diesel engine cylinders.

It would not be expected that chromate or other inhibitors would be particularly effective in preventing cavitation-erosion where mechanical factors predominate as they do in the laboratory vibratory tests. This was confirmed by tests made for the authors by William J. Rheingans of Allis-Chalmers and reported in his ASME paper.[2] The object was to discover in the Allis-Chalmers test setup whether chromate additions to the water would eliminate or reduce cavitation-erosion of cast iron, including the alloy iron regularly used for Diesel cylinders. For convenient reference, these results are summarized here in Table I.

Only in the case of the alloy cast iron liner material hardened by heat treatment was the addition of the chromate effective in reducing attack. Otherwise, the principal indication was that resistance to attack was a direct function of hardness—as might be expected where the mechanical forces were in control. The better response of the heat treated alloy cast iron to chromate inhibition shown in these tests was in line with its general superiority over plain cast iron in service.

The Allis-Chalmers tests failed to demonstrate the merit of the corrosion resistant austenitic cast iron Ni-Resist which in these tests performed, probably because of its low hardness, no better than plain iron and did not respond to the protective effect of the chromate inhibitor.

Just as the chromate inhibitors are more effective in practice than in the laboratory vibration tests, so the austenitic cast irons have performed much better in service than in the laboratory. Ni-Resist[4] liners are in common use—especially in truck Diesels on the West Coast—as a means of overcoming severe water side attack of the cavitation-erosion type, as well as providing improved resistance to corrosive wear on the piston side. The Ni-Resist liners generally show only superficial pitting after use for 90,000 mi., whereas cast iron liners are often pitted severely after 35,000 mi.

Attempts have been made to arrest the peculiar cavitation-erosion attack of Diesel liners by the application of protective coatings, including baked phenolics. These have not performed well and have failed within three months by a process that was described as "blasting off" in the areas subject to attack, followed by the immediate incidence of pitting of the bright metal exposed. These would be natural consequences of vibratory effects of the type believed to be operating.

On the basis of practical experience and the conception of the problem as one involving cavitation-erosion, as well as any ordinary corrosion, one or more of the following steps may be expected to provide effective remedies of the difficulty:

1.—Reduce vibration of the liners by any practical means, as by redesigning the liner supports to introduce damping effects or avoid opportunities for resonant vibrations at natural frequencies to become established.

2.—Develop and use more resistant liner metal. Hardened alloy cast iron liners appear to respond better than soft plain cast iron to chromate inhibition of corrosion.

3.—Treat the water with chromates in proper concentration, e. g. 2,000 p.p.m. or more and adjust pH to proper value, e. g. 8.5 to 9.5. Begin this immediately when the engine is put into service and maintain it thoroughly, since once attack has started, it may be difficult to arrest it. If attack has started, add suitable wetting agents which will not have a reducing effect on the chromate as determined by preliminary studies.

4.—Reduce the opportunity for vacuum cavities to be developed by: (a)) Keeping the water temperature as high as practical; (b) Keeping the water pressure as high as possible; (c) Introducing air bubbles to serve as cushions against vacuum bubble collapse—as is done with hydraulic turbines. This will, of course, require simultaneous use of chromate inhibitor.

On the basis of the authors' observations as described here, it is suggested that the ultimate solution to this peculiar corrosion problem will require the cooperation of the mechanical engineers with attention to mechanical features of the design and construction of engines. More thorough surveys of high frequency vibrations will be required before

[2] Rheingans, William J. Accelerated Cavitation Research, Paper presented before the A. S. M. E. November 29, 1949.

[3] Hansen, M. A. "Water Problems in Diesel Locomotives"—J. Am. Water Works Association, Vol. 40, No. 9, 1948. Also Bulletin 469 Am. Railway Eng. Association, Nov. 1949, p. 80-87.

[4] Registered, U. S. Patent Office.

TABLE I—SUMMARY OF RESULTS OF CAVITATION-EROSION TESTS OF DIFFERENT IRONS IN WATER WITH AND WITHOUT CHROMATE ADDITIONS*

Material	*Condition*	*Hardness Rockwell A*	*Loss in Weight in Milligrams in 120 Minutes in Cavitation-Erosion Test*		
			Distilled Water	*Water + 2000 P.P.M. Chromate pH 8.6*	*Water + 4000 P.P.M. Chromate pH 8.6*
Nickel Chromium Cast Iron[1]	As Cast	55	68	67	67
Nickel Chromium Cast Iron[1]	Heat Treated	71	59	36	31
Ni-Resist, Type 1[2]	As Cast	43	136	115	122
Ni-Resist, Type 2[2]	As Cast	35	166	166	181
Ni-Resist, Type 3[4]	As Cast	42	133	130	115

CHEMICAL COMPOSITION—Per Cent

	Tc.	*Si.*	*Mn.*	*Ni.*	*Cr.*	*Cu.*	*P*	*S*
1	3.15	2.14	0.64	2.17	...	...	0.08	0.08
2	2.97	1.82	1.21	13.82	2.24	6.14	0.08	0.08
3	2.74	2.32	1.20	19.98	2.00	...	0.08	0.08
4	2.47	1.81	0.71	29.75	3.00	...	0.08	0.08

* Data from Rheingans.

they can be eliminated by changes in design that probably need be only minor in nature. Such surveys can be made most effectively on engines operated under normal load conditions and fitted with devices for the detection of high frequency vibration of the cylinder liners.

The most economical solution of widespread problems of this kind is likely to proceed from well organized cooperative research—such as was the case with the effective work on the problem of cracking of steam boilers. The authors recommend that this method of attack be considered carefully by those most interested in improving the serviceability of Diesel engine cylinder liners.

Ordinary Corrosion

It may be noted that where the peculiar kind of corrosion which the authors have ascribed to vibratory cavitation-erosion does not occur, the control of ordinary corrosion and tuberculation in Diesel cooling systems is not difficult. All that is required is the use of water of good quality, low in dissolved solids and treated with an inhibitor such as sodium chromate and caustic soda to a pH of 8.5 to 9.5. About 500 p.p.m. of sodium chromate will usually be sufficient, but it is common practice to run on the safe side and keep the chromate concentration above 2,000 p.p.m. as described by Hansen[3]—or even as high as 5,000 p.p.m. where salt water is used for cooling. In cooling water systems which include aluminum surfaces in contact with the water it has been suggested that the pH be reduced to something of the order of 7.0 and certain proprietary inhibitors have been developed to provide protection to both iron and aluminum at this pH level.

Where proper treatment of the water has been delayed so that some corrosion scale has formed, a wetting agent (compatible with the inhibitor) can be used to advantage to aid diffusion of the inhibited water to the metal surfaces.

Crevice Corrosion

In addition to the peculiar corrosion identified as cavitation-erosion as just described, there are occasional occurrences of severe crevice corrosion in way of liner supports and especially under the rubber gaskets used to seal the water passages at the bottoms of liners. Attack of this sort is illustrated by Fig. 3.

The mechanism of this attack is believed to involve differential aeration or oxygen concentration cell effects with the iron within the crevice or under the gasket being anodic to the freely exposed iron.

This corrosion is difficult to arrest by the use of passivating inhibitors of the chromate type, since these won't reach the iron within the crevice that requires protection. They may even aggravate the attack by their passivating effect on the freely exposed iron and by acting as depolarizers of the cathodic surfaces.

The most likely remedies would be to apply a protective coating to the iron within the crevices or to use a plastic sealing compound, such as low melting point asphalt, that would survive exposure to the hot water for long periods and that would be heavy enough not to be floated away.

Fig. 2—Erosion of water side of large Diesel engine which progressed to perforation of cylinder wall

Fig. 3—Crevice corrosion of Diesel cylinder liner under rubber sealing gasket

Occasionally, also, there is some galvanic corrosion of cast iron jackets which are undercut around copper gaskets, such as are sometimes used at the tops of liners. Such galvanic action can be prevented by maintaining a proper concentration of chromate inhibitor.

The authors wish to acknowledge the help of William J. Rheingans of the Allis-Chalmers Company, Milwaukee, Wisconsin, for his help in carrying out the tests to show effects of chromate inhibitors in his vibratory cavitation-erosion testing apparatus.

ELECTRICAL SECTION

The Vapor Degreaser In the Electric Shop

Experience with a vapor degreaser in the Rock Island's Silvis, Ill., shop shows they may be used with silicone insulation and indicates they are a "must" for every electrical repair shop

*By C. F. Steinbrink**

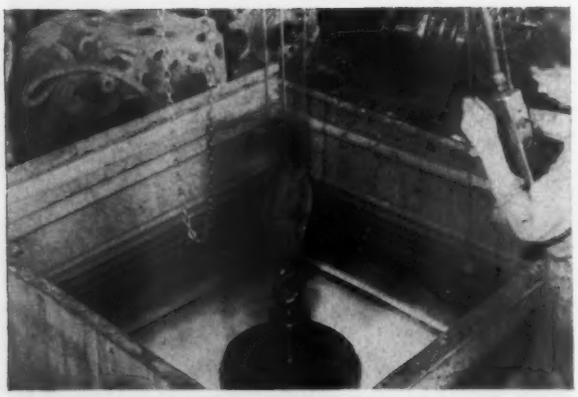


Fig. 1—A generator armature goes into the vapor

THE vapor degreaser is not new, only the application of its use for cleaning electric equipment is new. There is nothing mysterious about its use; it is a process developed for removing oil and grease from metal parts by placing them in a vat in which a chlorinated solvent has been vaporized. As these vapors condense on the cold metal, the fluid condensate dissolves and removes the grease and oil as it drains off the metal.

The conventional unit consists of an open tank in which solvent, several inches deep, is placed and heated to a point where it boils and causes vapors to be generated. This vapor rises in the tank and condenses on the cold parts suspended in the tank, draining back in the tank as a liquid, where it is again vaporized. This raising of the vapor and condensing would be a continuous process, but for the fact that the item suspended in the tank, whether it be an armature, set of field coils or piece of metal, soon becomes as hot as the solvent, and no further condensing takes place. Since the vapor might overflow the tank, some means of controlling the height of the vapor is necessary. This can be done by controls that will stop the boiling of the solvent or some means of condensing the vapor after it reaches a certain height. This can be done by air, water coils or water jackets. Most machines use both methods. The vapor is condensed at a certain fixed height and a thermostat is applied a couple of inches above the vapor line so that if more vapor is generated than can be condensed, then the rise of the vapor above this line will operate the thermostat and stop the boiling of the solvent.

* General Electrical Foreman, Chicago, Rock Island & Pacific.

Condemned Without Evidence

Too many engineers, unfamiliar with the results obtained by the use of the degreaser, have condemned its use for cleaning electrical equipment. These men are connected with manufacturing some part of the electrical apparatus such as the insulation material or the varnish, and they condemn its use without knowing about the results being obtained. For example, an engineer connected with one of the largest manufacturers of electrical apparatus stopped in the shop, and wanted to see a vapor degreaser operate since he had never even seen one in use. This man told me he had just given a paper at one of their monthly meetings. Of course, I made it my business to get a copy of this paper and I can honestly say it was very well written, but you could not find one good word for the use of the degreaser. It may be only a coincidence that this company does not make a varnish that can be cleaned in a vapor degreaser. When we first had the degreaser in operation, some

Fig. 2—Moisture coming out of the armature clouds the vapor

of the varnish manufacturers brought their varnish customers to our shop and tried to convince them that we were removing the varnish and destroying the windings. Usually the customers went away more sold on the degreaser than before.

Experience

The application of the degreaser for cleaning electrical equipment was not adopted before it was given a very thorough test. I had seen a couple of degreasers in operation cleaning metal, and had also seen them used for softening the varnish for stripping armatures and stators. I got the idea that if we could get a varnish which would not be softened or removed by the solvent, there would be a big time and labor saving. Also, the degreaser would do a more thorough job of cleaning electrical equipment than we were doing by other methods. I have visited several railroad electrical shops, as well as several large street car repair shops, and in almost every case, more men were employed in cleaning the apparatus than were used in repairing it. Some had shops outside in the open—some had enclosed buildings with very elaborate fire protection, as most cleaning was done with some petroleum product, and in not one case could you say the condition of the apparatus was satisfactory after it was cleaned. The type of men used on the work were very low grade, as it was impossible to get any craftsman to work in this dirty condition.

I knew what it was costing us, and I also knew it was not satisfactory. I made contact with several manufacturers of degreasers, and told them my story, and what I wanted to do. Not one of the manufacturers wanted to even try it out, but I kept on trying, and eventually found a manufacturer who was willing to help work out something. We then made up a small degreaser about two feet square and one foot high. Next, I wrote to several varnish manufacturers, but after telling them the story we got practically the same results. None of them wanted to try their varnish. Eventually, we gathered together about seven or eight brands of varnish, and under test, only one of the samples proved satisfactory. For the purpose of the tests, we made up a number of coils insulated with the various varnishes. These were put through the degreaser, and then given a number of severe tests both in the shop and laboratory. Of all the varnishes tested only one of them proved satisfactory.

In making these tests we were using a solvent of trichlorethylene, which has a boiling temperature of 188.8 deg. F. Next we tried tetrachlorethylene, which has a boiling point of 249.8 deg. F. This high boiling point also removed all the moisture, and we have been using it ever since.

All shop operators know what a task it is to get moisture out of a piece of electrical apparatus. It was nothing unusual to spend a week, and sometimes longer, to remove the moisture from a large generator armature. Since the degreaser has been in service, we have eliminated the moisture problem entirely.

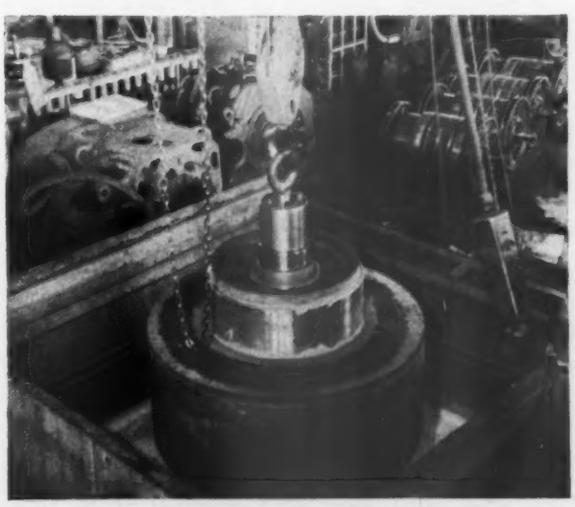


Fig. 3—The armature is lifted out of the vapor while it is still cloudy, indicating a longer immersion is needed for complete moisture removal

Removal of Moisture

Several years ago, one of the generators on a fairly new locomotive was running through some territory in which it encountered several severe snowstorms, and the generators became water soaked. The generators became so bad that they did not complete a trip for several weeks. The manufacturer of this equipment would attempt to bake out this equipment, and on several attempts it was put in the oven two and three days at a time, but each time it was put back in service, it would again fail after a week or ten days operation. When this generator first came to the shop, I volunteered to remove the moisture, but the service man who was supervising the work, said he had had very specific instructions not to put this generator through our degreaser. After several attempts by the manufacturer, our management told me to repair this generator and get it back in service. We put the armature through the degreaser and the first cycle brought the resistance to ground from 0 megohms to 300 megohms, and on the second cycle, the resistance went over 2,000 megohms, which was the capacity of our megohmer. This generator is still giving satisfactory operation after three years' service. The same company has since installed degreasers in practically all its service shops and is using them for cleaning traction motors and generators.

To demonstrate the removal of moisture, several photographs were taken of a main generator armature being put through the degreaser. Figure 1 shows this armature lowered into the degreaser. Figure 2 shows the close-up view of the same armature in the identical position. These photographs show very clearly the removal of the moisture. The vapor is transparent, and if there is no moisture present, the vapor line is not visible. Only the condensate can be seen, as it runs off the part suspended in the tank as a colorless liquid. These photographs show a steam-like vapor which can easily be seen, and which is the water being removed from the armature. The degreaser is equipped with several water traps and when we first applied these traps, it was necessary to keep continually draining the reservoirs. This took too much time, so they were made self-draining, and it is not unusual to drain off several quarts in a day's operation. Figure 3 shows the armature being removed from the degreaser and it may be seen there is still considerable moisture present in the vapor in the tank. After this armature was tested with a megohmer, it still contained some moisture and had to be given a second cycle.

Service Life of Motors and Generators

We have traction motors in service that have accumulated over a million miles and have been shopped, and put through the degreaser four to five times. Most of our traction motors have been through the degreaser at least two times, and many main generators have been through the degreaser at least once.

Before using the degreaser, it would often be necessary to drill the air vents left in the motor laminations after about every third shopping as the accumulation of dirt would block these passages. Since using the degreaser, these air passages are just as clean as they are with a new set of laminations.

Degreasers and Silicone Coils

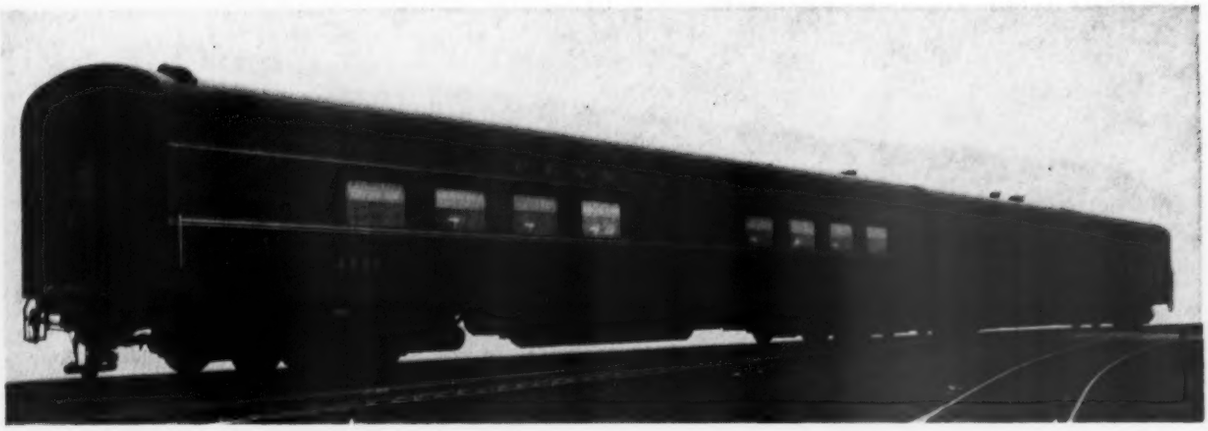
The question is raised as to what effect the degreaser will have on silicone coils, and in this connection, I might say we have been winding our armatures with coils having considerably more silicone than the so-called "silicone coils" now being extensively used by one of the manufacturers of this equipment. We have been using the coils for a good many years. In fact a large part of our experience with the degreaser has been with these silicone coils, and you can be sure it will not have any detrimental effect on the outside binder, which is, of course, not silicone varnish, but usually a synthetic varnish having a bakelite base.

We have also run several sets of 100 per cent silicone coils through the degreaser without doing any damage, as these armatures have all been previously impregnated with another type of varnish.

The question most frequently asked is how long we suspend an armature, or a set of coils in the solvent. When we first started using the degreaser we would leave the part, being cleaned, in the vapor only four or five minutes, but we have since learned this was not necessary. We therefore, put the part being cleaned in the degreaser unattended and leave it complete a cycle which takes from 10 to 20 minutes, depending upon the size of the part being cleaned.

In conclusion, I can say no piece of equipment we have in our shop has done more to cut the cost of overhauling electrical equipment, and the degreaser should be a must in any electrical shop that expects to meet outside competition and show a return on the investment necessary for a modern railroad electric repair shop.

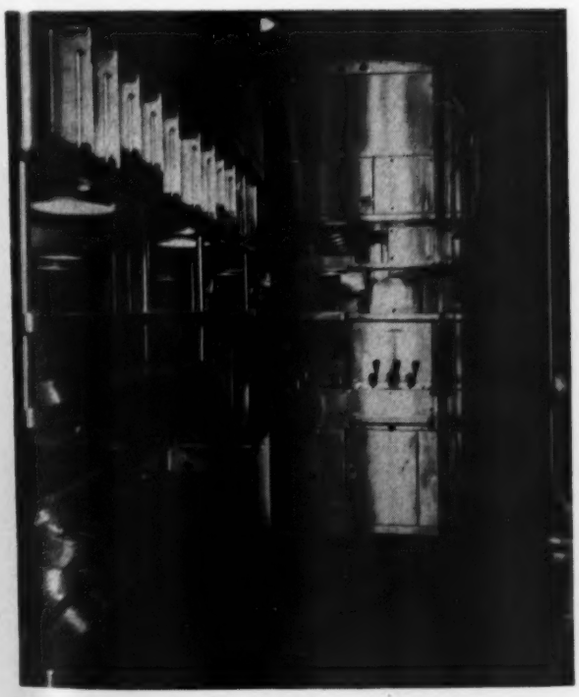
The General Electric 4,500-hp. gas turbine-electric locomotive has started its second year of test in freight service on the Union Pacific after undergoing thorough shop inspection following completion of its first year of operation—It is shown hauling a mile-long freight train near Sloan, Nevada—Caboose immediately to the rear of locomotive provides working space for G.E. engineers who observe performance and note operating data



The all-electric kitchen car and diner

Twin-Unit Diner With All-Electric Kitchen

Pennsylvania application has demonstrated the practicability of using axle generators and batteries to develop the large power requirements of all-electric kitchen cars



The pantry showing the coffee urn and hot table

THE twin-unit diner with all-electric kitchen, which was built by the American Car & Foundry Company for the Pennsylvania, has been in service approximately one year, during which period excellent results have been obtained from all the apparatus.

The railroad's program includes 16 twin-unit diners, but only one of the twin-units has a complete all-electric kitchen. The remaining 15 have electric kitchens with the exception that coal ranges are used in place of the electric range.

The twin-unit, all-electric diner consists of a full length, 64-seat, air-conditioned diner having an overall length of 85 ft. It is constructed of high tensile steel, equipped with cast steel frame, 4-wheel trucks, wheel slide control, and electro-pneumatic brakes with speed governor. The car is provided with fluorescent lighting, automatic door mechanisms, public address system and other refinements to add to the comfort and luxury of the patrons. The associated unit, which is also 85 ft. long overall, is a kitchen-dormitory car consisting of a 36-ft. all-electric kitchen-pantry, and a sleeping section having 18 berths for the dining car crew, a crew's lavatory, and a stateroom for the steward. All of these sleeping areas are air-conditioned and provided with an improved system of illumination.

The electrical apparatus in the kitchen-pantry sec-

One side and end of the kitchen showing the range and broilerizer

tion includes individual floor-mounted refrigeration units for the main refrigerator, low-temperature refrigerator, pantry refrigerator and ice cream cabinet, combination charcoal-electric broilerizer, combination steam-electric coffee urn, combination steam-electric hot table, electric dishwasher, glass sterilizer and full electric range.

Each food refrigeration unit consists of a direct-expansion (freon), 2-cylinder condensing unit employing a ⅓-hp., 220-volt, 3-phase, 60-cycle belt-driven motor and air-cooled condenser. The evaporator is of the extended surface, forced air type, with a 1/100-hp. shaded-pole, 115-volt, single-phase, 60-cycle, motor-driven fan which operates only when the door is closed. A small 4-watt, 115-volt fluorescent germicidal lamp, which is also energized only when the door is closed, provides for the sterilization of the compartment.

The combination charcoal-electric broilerizer consists of an adjustable grille beneath which there is an adjustable charcoal hearth. Above the grille, there is a nominal 4-kw. electric broilerizer consisting of four separately controlled units and each of these units consists of three elements of which element No. 1 is used on direct battery operation. Element No. 2 is used when the generator is in operation with the lead-acid battery, and element No. 2, plus element No. 3, is used when the generator is in operation with an Edison battery. With each of the above operations, approximately 4 kw. of energy is consumed, thereby affording substantially constant heat with a voltage variation of 97 to 160 volts direct current. Switching from one set of elements to another is automatically accomplished by means of contactors energized through the generator reverse current relay. A low-voltage relay cuts off the elements in the event of low battery voltage.

The combination steam-electric coffee urn is equipped with low pressure (15 lb. per sq. in.) steam heating coils and two sheathed electric heater elements. The automatic control of these electric heaters is arranged similarly to that of the broilerizer, but with both elements in parallel on direct battery operation. The No. 1 element is used when the generator is in operation with a lead-acid battery, and No. 2 element is used when the generator is in operation with an Edison Battery. The temperature is controlled by means of an adjustable thermostat and a low water cut-out is also provided. The switching from one set of electrical elements to the other is automatically accomplished by means of contactors energized through the generator reverse current relay. The broilerizer low-voltage relay affords low-voltage protection for both the coffee urn and hot table. The above-mentioned automatic switching arrangement, in combination with the thermostatic control, provides uniform heat with a voltage variation of 97 to 160 volts direct current.

Opposite side of the kitchen as shown in another illustration—the dishwasher may be seen in the foreground

The electrical control of the combination steam-electric hot table operates on the same principle as the coffee urn, but the energy consumption is approximately 2 kw. as compared with 4 kw. for the coffee urn.

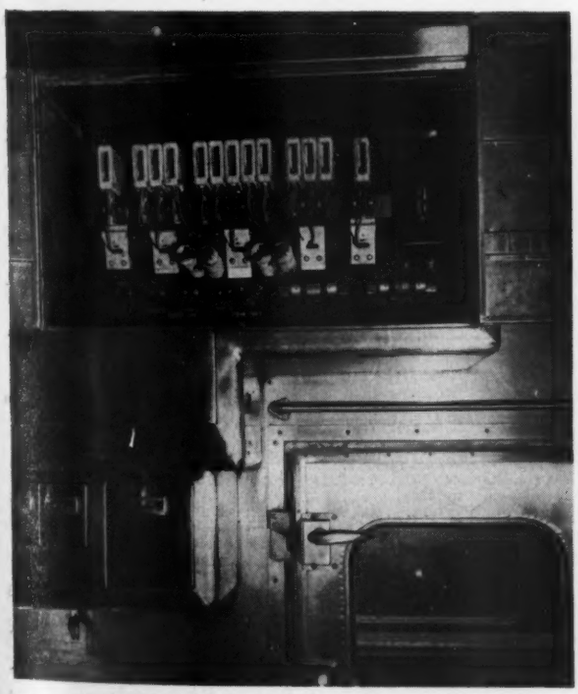
The electric dishwasher operates on the principle of spraying 140-deg. F. water alternately from top and bottom jets for approximately 50 seconds during the washing period, followed by a 12-second dwelling period, then a 10-second rinse period with 190-deg. F. water, and a 2-second rest period before recycling. The flow of rinse water is controlled by a solenoid valve which prevents the flow of 140-deg. and 190-deg. water simultaneously. The unit consumes approximately 30 gallons of 190-deg. water per hour in normal service. Temperature gauges are provided for both wash and rinse water, and the unit has pushbutton control.

The coordination of the various functions of the unit is handled by an electric timer and the wash

Interior view of the dining room

water is circulated by means of an 80-gal. per min. centrifugal pump, belt driven by a ¾-hp., 220-volt, 3-phase, 60-cycle motor. A small motor-driven centrifugal fan removes the steam vapor from the cabinet and thus prevents it from entering the body of the car.

The sterilization of drinking water glasses is accomplished with an 18-in., 15-watt, 115-volt, a.c. fluorescent germicidal lamp.

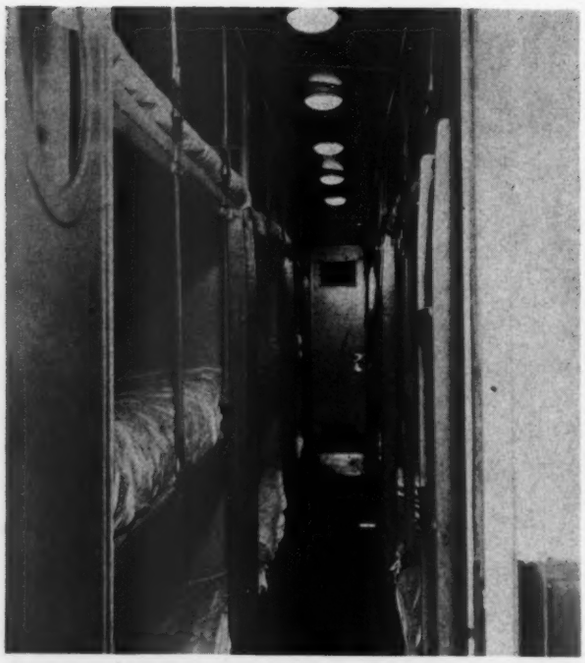


The broilerizer control panel over the door in the kitchen

The full electric range consists of three units, each of which has two hot plates rated 2.5 kw., and each hot plate has three heating elements. All of the range units are equipped with ovens, each oven having a top heating element rated 1.5 kw. at 115 volts and a bottom heating element, also rated 1.5 kw. at 115 volts. The oven temperature is thermostatically controlled. Each top plate has a four-position switch for controlling the degree of heat by combining elements, series, series-parallel and parallel. To compensate for the difference in voltage between direct battery operation and gnerator operation, a transfer bus is automatically brought into service whereby the third heating element is energized in series with the other elements on generator operation. A low voltage relay is employed to cut off all range heating elements in the event of low battery voltage.

The control for all of the d.c. kitchen electrical apparatus is electrically interlocked with the lighting, so that, when the lighting is turned off, these units are de-energized to prevent the heavy drain on the battery during layover periods, which could occur if the manual switches for these units were left in the *on* position at the end of the run.

Provision is made for the utilization of 220-volt, 3-phase, 60-cycle standby energy at the terminals for the operation of the a.c. kitchen and pantry apparatus. This eliminates the necessity of operating the 8-kva. amplidyne booster inverter during the layover periods. This feature is accomplished by means of a transfer relay, three-pole, double-throw type, having a.c. coils and electric interlocks; also, coordinated time delay relay and mechanical interlocks insure the proper transfer of the load from one source of supply to the other.



The crew's dormitory

Drinking water is obtained from a tank-type cooling unit. It is rated 15 gal. per hr., reducing the water temperature from 80 deg. F. to 50 deg. F., with 90 deg. F. ambient temperature. Water is supplied to two faucets, one at the alcove adjacent to the unit, and the other back of the bar at the center of the car. This cooling unit, which is located in the main dining car in a compartment at the coupled and also supplies cooling for two beverage refrigerators back of the bar. The refrigeration unit is similar to the ⅓-hp. units in the kitchen.

Incandescent lighting, operating on 115 volts d.c., is employed in the kitchen, pantry, dormitory and steward's section, but the marker lights are on 32 volts d.c. The passageway is illuminated with 115-volt a.c. type, T8 fluorescent lights.

Three exhaust fans insure adequate ventilation at all times. One, a centrifugal type, 1,800-c.f.m., ½-hp. unit, is located in the kitchen. A 12-in. diameter propeller type fan removes vitiated air from the dormitory section, and another 12-in. diameter propeller type fan removes air from the crew's lavatory and electric locker. Filtered fresh air is admitted to the pantry and kitchen areas through a grilled opening in communication with the area above the inner diaphragm at the coupled end of the car.

An 8-ton Frigidaire direct-expansion system of air-conditioning is employed to provide *comfort* conditions in the passageway and sleeping areas. The compressor motor is a 15-hp., 126-volt, d.c. unit, while the evaporator blower motor and condenser fan motor are each 1-hp., 220-volt, 3-phase, 60-cycle units.

An 8-kva., 220-volt, 3-phase, 60-cycle, General Electric amplidyne booster inverter provides alternating current energy for the operation of all of the above-mentioned air-conditioning units.

The primary electric power supply is comprised of two 25/30-kw., axle-driven, body-suspended, General Electric motor generator sets, one driven from an axle on each truck by means of a 2.54 gear ratio Spicer drive with automatic clutch. Each generator has current and potential regulation to protect against overload and control battery charging. Parallel operation of the generators with assurance of equal division of the load is obtained by means of biasing coils on both generator regulators which measure and equalize the output from the generators. The motor portion of each unit is rated 25 hp., 220-volts, 3-phase, 60-cycles. Receptacles are provided to supply 220-volt, 3-phase, 60-cycle standby yard or terminal power for driving the motor generator, at which time the d.c. output is limited to approximately 15.5 kw.

Standby power on the road is supplied by 110-volt, 1,020-amp.-hr. storage batteries. The nickel-iron-alkaline batteries consist of 90 cells A24H assembled in 23, 4-cell trays, one tray having only 2 cells.

The following tabulation gives an analysis of the electrical load on the kitchen-dormitory car:

TABLE I.

Items	Connected Load K.W. (D.C.)	Connected Load K.W. (A.C.)	Estimated Normal Operation K.W. (D.C.)	Estimated Normal Operation K.W. (A.C.)
Refrigeration	...	1.5	...	1.5
Ventilation	...	0.7	...	0.7
Air conditioning	10.0	2.0	10.0	2.0
Incandescent lighting	1.7	...	1.7	...
Fluorescent lighting	...	0.2	...	0.2
Three ranges (top plates)	15.0	...	10.0	...
(ovens)	17.4	...	5.8	...
Broilerizer	8.0	...	4.0	...
Hot table	2.0	...	1.0	...
Coffee urn	4.0	...	2.0	...
Ventilation for condensers of refrigerator	...	0.4	...	0.4
	58.1	4.8	34.5	4.8

In road service, the two axle motor generators have handled the above-mentioned loads and kept the battery properly charged. From checks that have been made, the 1,020-amp.-hr. battery, with certain supervision of the load, will provide the required electrical energy for approximately 4 to 5 hours' service.

The kitchen and pantry is furnished in stainless steel throughout and every consideration has been given in the layout to insure cleanliness, efficiency and utility, to the end that the patrons are provided excellent cuisine.

The following tabulation gives an analysis of the electrical load on the main diner which is equipped with one 25/30-kw. axle motor generator and a 510-amp.-hr. battery:

TABLE II.

Items	Connected Load K.W. (D.C.)	Connected Load K.W. (A.C.)	Estimated Normal Operation K.W. (D.C.)	Estimated Normal Operation K.W. (A.C.)
Refrigeration	...	0.75	...	0.75
Ventilation (exhaust fans)	...	0.25	...	0.25
Air-conditioning	10.0	2.0	10.0	2.0
Incandescent lighting	0.5	...	0.3	...
Fluorescent lighting	...	2.0	...	2.0
	10.5	5.0	10.3	5.0

This car is equipped with wide panorama windows with attractive draperies, soft upholstered chairs, individual table lights, flower vases and a general decor comparable in all refinements to the finest dining rooms having the comfort and convenience of the patrons as the first consideration.

Pallet Handling of Batteries

New York Central's battery shop at Collinwood improves battery handling and greatly reduces time required to supply a yard with reconditioned batteries

*By G. S. Glaiber**

A pallet loaded with batteries goes into a battery car

BEFORE the Collinwood, Ohio, battery shop of the New York Central was modernized, much thought was given to the best utilization of floor space to give the maximum battery storage capacity. Heretofore, the battery sets had been stored on benches constructed to be at the height of the truck used for transporting them. This confined them to one level only. As the number of battery sets in use continued to increase, due to Dieselization and air conditioning, more bench space was needed, as well as increased charging capacity. Estimates of additional covered floor space to accommodate the increased turn-over showed clearly that serious thought should be given to better utilization of the floor space by tiering the batteries.

The problem was carefully studied by material handling experts who showed how the batteries could easily be handled on pallets and raised by means of a fork truck. It would permit safe handling to three levels, a half a set at a time for air conditioning and Diesel batteries, and a complete set for the other types. A complete set consists of four large trays at a time or eight small ones. When the batteries are lifted to the topmost tier, they are raised well over ten feet from the floor level.

It was shown by a number of tests under actual working conditions that the proposed method was workable. Then plans were drawn up along the lines of palletized battery handling to three storage levels.

Results are Satisfactory

The shop addition has since been completed and the pallet handling has been in constant use for over six months at this shop. It has also been installed in a few outside points. Results have been exceptionally good and several improvements have been made on the original idea. The batteries are shipped on pallets to some of the yards, and the method is

Protective frame which serves as blocking during shipment being slipped down over a battery on a pallet

* General supervisor electrical equipment, New York Central System.

spreading as more yards acquire means for handling the batteries in this manner.

As an example of how palletization operates for handling storage batteries, we can follow a battery set from the time it was put on a pallet at the yard. The battery trays are placed on the pallet, and to protect them from toppling in lifting into the battery car, a protective frame is placed around them as illustrated. This also acts as blocking en route. The pallet is lifted with a fork truck to the floor of the battery car—a retired baggage car assigned to this service—and moved in express trains. Inside the car is a hand-operated pallet mover which lines the pallets up in the car, four abreast. At the floor line of the inside wall of the car, spaced for pallet length are steel ways for holding the pallets in place. They serve as removable blocking for the pallets. Forty pallets of batteries made up of four large trays, or eight small ones per pallet, can thus be transported without a nail being driven into the car floor. Beginning in the yard, the labor savings of this system are evident. On the average, thirty-six hours after the battery car is loaded, it is at the battery shop ready to be unloaded.

The pallets are moved to the car door by means of the pallet mover which stays with the car. They are taken out of the car by the shop fork truck and moved to the shop where the batteries are reconditioned. The trays are slid from the pallet to the bench and their inspection and subsequent conditioning is started.

When a battery set has been reconditioned and passed as serviceable, it is re-palletized and transferred to the storage room shown in one of the illustrations. In the meantime, the battery car is loaded, perhaps the same day, from the storage room with serviceable batteries of the capacity requisitioned, and the car immediately returned to its home yard. In a typical case, the battery car can be loaded at the yard with 20 or 25 sets of defective batteries on Friday, and be back to the same yard with reconditioned batteries by the following Wednesday at the latest.

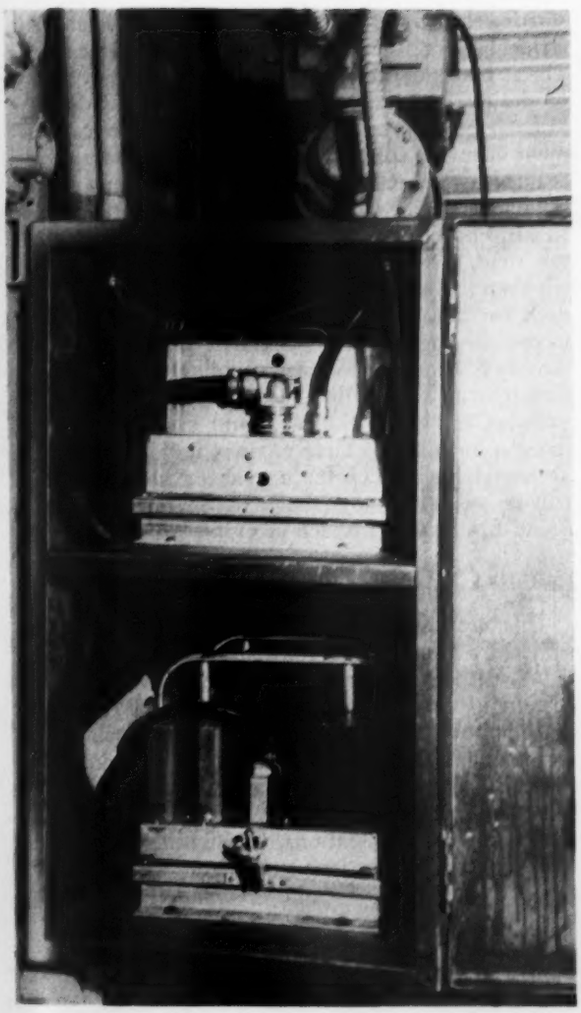
Taking a pallet of batteries from the top tier

There are eleven such battery cars operating out of Collinwood, which serve as a battery room for the yard they serve, thus gaining valuable floor space in yard buildings for other uses.

With the former system of loading batteries, a single tray at a time, several days were consumed in lining them up on the car floor and then blocking them in. With the pallet handling, a car can easily be loaded and made ready to move in a half day.

A complete set of baggage car batteries on one pallet

Power for Train Radio



One typical installation on a locomotive, including a rotary converter, and in the case, a transmitter-receiver on top shelf, and a power supply on lower shelf

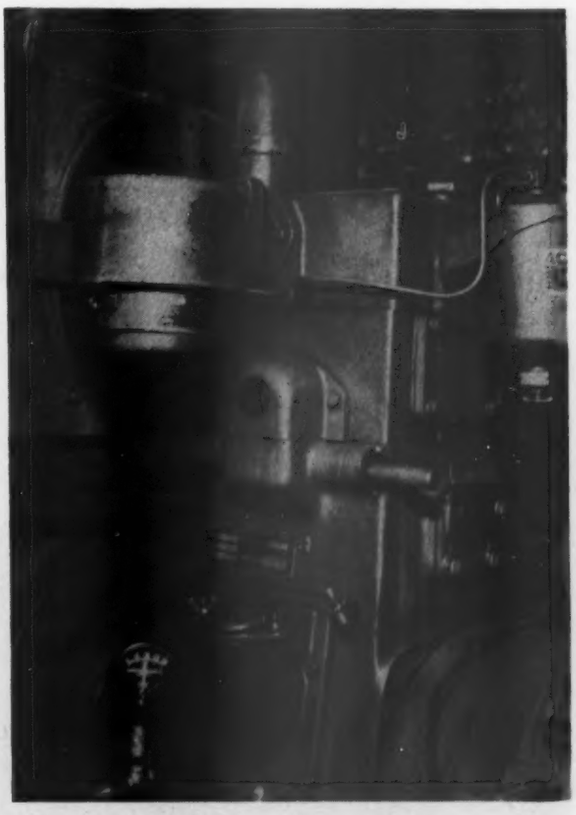
THE Atchison, Topeka & Santa Fe has installed radio train communication equipment on 28 locomotives and 36 cabooses used on through freight services on three freight operating districts which center at Barstow, Calif. The project also includes radio transmitting and receiving apparatus in three wayside offices. Barstow is 141 miles east of Los Angeles on the 2,224-mile through route to Chicago. West from Barstow toward Los Angeles, a double-track district 81 miles long extends over the mountains with heavy grades in both directions to San Bernardino, which is 60 miles from Los Angeles. East from Barstow toward Chicago, one double-track district extends 167 miles to Needles, Calif. West from Barstow, toward San Francisco, one single-track district extends 141 miles to Bakersfield, Calif.

The radio is in service on all of the cabooses assigned to through freight service on these three districts. The 28 Diesel-electric freight locomotives, which are now equipped with radio, are in a pool at Barstow for operation on any of the three districts. These locomotives run through on other districts before returning to Barstow.

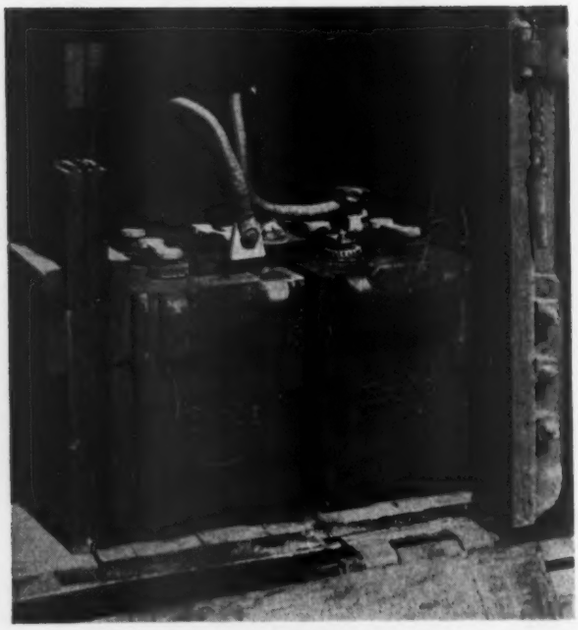
Power on Locomotives

Operation of the radio equipment on each locomotive or caboose requires 115 volts, 60 cycle a.c., approximately 145 watts standing by, 175 watts receiving, and 230 watts sending. On each locomotive, this a.c. power is supplied from a rotary converter made by the Eicor Company. These converters are rated at 115-volts, a.c., 300 watts output, and 64 volts, d.c., input. The 64-volt input is from a storage battery used also for starting the Diesel engines on the locomotives.

The Diesel engines are operated constantly while the locomotives are in service, as well as when they are waiting between runs. This practice is used to obviate engine troubles that might be caused if allowed to cool between runs. Similarly, the radio



On each caboose the 115-volt a.c. power is supplied by a 2.5-kva. alternator that is direct-connected to a Diesel engine



The battery for starting the engine is rated at 32 volts 180 amp.-hr.

on the locomotives, including the rotary converters, is run continuously, except when a locomotive is taken out of service for inspection. This constant operation was a factor in causing the Santa Fe to adopt the policy of changing-out these converters every 90 days, and giving them a thorough inspection and test in the shop before restoring them to service.

Power on Caboose

On each caboose, the a.c. power for the radio is furnished by a direct-connected Diesel-engine driven a.c. alternator, the output of which is rated at 115 volts, 2.5 kva. when operating at 1,200 r.p.m. These machines were furnished by the Lister-Blackstone Company, Milwaukee, Wis.

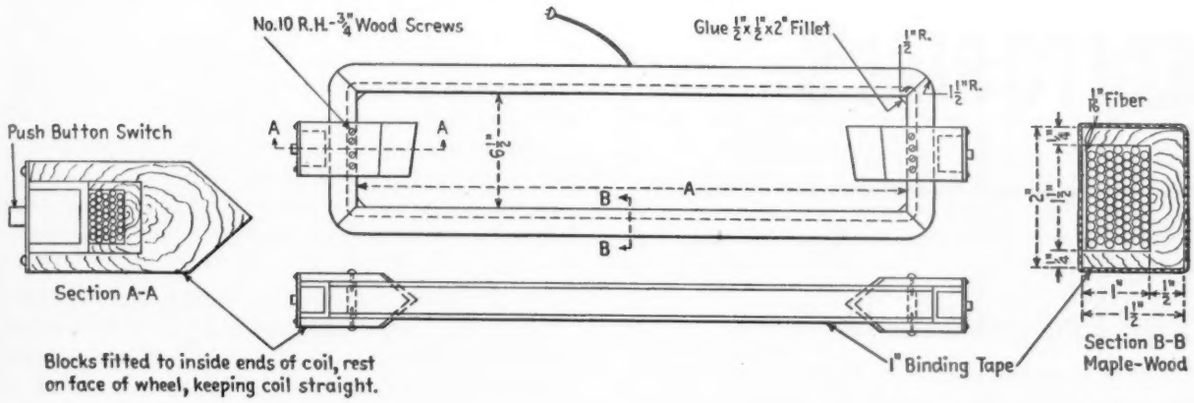
These engine-generators are started by pushbutton control, the same as an automobile engine. The starting battery consists of a 32-volt, 180-amp.-hr. Exide battery, located in a box under the caboose. These batteries are charged by the starting motor of the engine-generator set.

Each engine-generator is enclosed in a compartment near one end of the caboose. This compartment is lined with sheet metal and fire-proof sound absorbing material. The engine runs so smoothly, and makes so little noise that, when a caboose is in motion on the road, a man seated in the caboose cannot tell whether the engine is running. The fuel oil tank on each car has a capacity of 25 gal., and is adequate to run the engine for approximately 75 hours, which is more than needed for any round trip out of Barstow and return. These Diesel engines are given a compression test every 90 days, and experience for 12 months on some of these engines indicates that they are good for service for a year or more, before it will be necessary to remove the engine from a caboose for further inspection or repair.

Installed by Railroad

This train communication was planned and installed by Santa Fe forces under the jurisdiction of G. H. Minchin, vice president, and under the direction of J. P. Morris, assistant to vice president (mechanical), J. A. Parkinson, superintendent of communications, and L. R. Thomas, electronic engineer. The installation and maintenance is under the direct supervision of C. O. Overbey, assistant superintendent of communications, Coast Lines, and M. D. Breeden, communications supervisor, with headquarters at Los Angeles. The major items of radio equipment were furnished by Bendix.

One of eight General Electric Diesel-electric locomotives which replaced steam motive power in October, 1948 in switching service on the Rio de Janeiro docks—According to officials of the Administracao Do Porto De Rio De Janeiro, fuel consumption performance records show that annual fuel savings through the use of these locomotives (six 45- and two 65-tonners), will average more than $10,000 per unit — At this rate, officials estimate that the switchers will pay for themselves out of fuel savings in about 3½ years



Magnetizer for Wheel Inspection

The coil is wound into a maple frame which encloses three sides of the coil. The outer edge of the coil slot is filled with a piece of $\frac{1}{16}$-in. fiber and the entire coil including the frame is wound with 1-in. binding tape, after which it is dipped in insulating varnish and baked.

At each end of the coil, there is a maple guide block, so shaped that when the coil is placed on the wheel, it will be at right angles to the wheel.

Also on each guide block there is a switch. Both switches are in series with the coil, and the one farthest away from the operator is kept closed. The one under the operator's hand, as shown in the photograph, is closed as he needs magnetization.

When in use, the coil is allowed to go down on the wheel as far as possible with the guide blocks in contact with the tread. The coil is designed for service only when the wheel is acting as a magnetic core, and the current should not be applied when the coil is not on a wheel.

The coil shown in the drawing was developed in the San Francisco shops of the Southern Pacific for magnetizing wheels for magnetic particle inspection. It operates on 110 volts a.c. and draws 15 amp. The magnetic field developed is sufficient for making tests over the entire surface of the wheel, including the plate and hub. To provide the most effective magnetic particle indications when testing for tread defects, the tests should be made close to one end of the coil as shown in the photograph.

For wheels of 34- to 36-in. diameter, the coil is wound with 105 turns of No. 11, Formex insulated wire and the dimension *A* is 31¾ in. For wheels from 40- to 42-in. diameter, the coil has 100 turns of wire, and the dimension *A* is 35¾ in.

One of two sealed-beam inspection lights mounted on the rear of an Erie business car—The lamps are mounted in Pyle National 10585-S adapter plate—The conventional reflector and lamp were removed and the adapter plate carrying the hinged cover ring was then installed to replace the original cover—The coverglass is omitted when sealed-beam lamps are used

EDITORIALS

The Freight-Car Outlook

Although there have been ups and downs in some of the commodity groups, first-quarter freight-car loadings as a whole have declined each year since 1947. So there is little pressure in the immediate situation for an increase in the current car supply. A characteristic feature of the railroads' practice in the acquirement of new freight cars is their reluctance under such conditions to draw on their credit for the purchase of new cars no matter how great the need for an improvement in the quality of the inventory. Four announcements which appear in the news pages of this issue all promise, if not a complete change in this attitude, at least some amelioration of its effect in withholding car improvements until an increase in the volume of traffic again exceeds the capacity of the car supply.

Two builders have disclosed their intentions of bringing to the attention of the railroads at an early date new cars with features which are believed to possess advantages attractive alike to the railroads and the shippers. The third announcement is that of the Equitable Life Assurance Society of a proposed purchase plan in the development of which Pullman, Inc., participated, under which railroads may acquire new freight cars on a straight rental basis without a down payment or ultimate responsibility of ownership. The fourth announcement, is of a proposed leasing plan whereby the use of the new car type under development by the General American Evans Company may be acquired by the railroads. Such a plan is already well established in relation to other cars of special types not needed in large quantities by the railroads.

When business is light a relatively high percentage of orders for freight cars are placed with the railroads' own shops. There are several reasons for this. Building new cars helps to keep a shop organization together. Whether or not the ultimate cost to the railroad is lower than the builder's price usually depends upon whether the railroad cost can be figured on a marginal basis or on an overall basis, a question which can be resolved only by a determination of the facts in each case. This, however, becomes an academic question for builders who are prepared to build cars of new types possessing operating and service advantages. Combine these advantages with attractive opportunities for financing the acquirement of the cars and the immediate prospect from the standpoint of the car builders is considerably improved.

No doubt several questions will have to be resolved before the Equitable plan of financing is completely worked out. An obvious one is maintenance. Ordinarily maintenance is a responsibility of ownership. To the extent that the integrity of the investment depends upon the maintenance of the property under the Equitable plan, that responsibility is transferred from the railroad to the owner, but the work will probably continue to be performed by the railroads, handling lines as well as the renting road itself.

If and when contractual relationships with respect to these questions are successfully established, this plan should effect some degree of relief of what has always been a feast or famine business.

The General-American-Evans proposal for leasing its new car type should likewise help the railroads to acquire equipment of immediate value to them without awaiting the return of a peak traffic period, provided the terms on which a high-price car can be leased are such that the service it can render will insure a commensurate return.

A Simple Solution To Recurring Problem

With the approach of summer and the attendant hot weather it is timely to begin considering the problem of providing reasonable comfort for the men working inside engine compartments of Diesel locomotives. The lack of ventilation makes any work within the confines of the engine compartment suffer in both quantity and quality because of the discomfort which handicaps the worker in the performance of his duties.

Some roads have materially improved the conditions within the engine compartment by a comparatively simple arrangement which utilizes one of the cooling fans for ventilation. A double-throw switch is applied to the locomotive to control the last cooling fan in the operating sequence. A receptacle is applied to a bracket on the bottom of the locomotive frame to bring in the shop current necessary to operate the fan. Connection is made to this receptacle through a jumper wire from a second receptacle, one of which is mounted adjacent to each servicing stall. Throwing the switch one way connects the cooling fan to

the locomotive current supply, and throwing it the other way connects the fan to the shop current.

The arrangement furnishes ventilation throughout the engine compartment without concentration of high-velocity air currents in one place and virtually still air in another. It has no serious drawbacks. By using the cooling fan that cuts in last as the cooling requirements increase, the extra wear takes place on the fan that is used least during road operation. Using the final fan to cut in also reduces what risk there might be from forgetting to throw the switch back to connect the fan to the locomotive current, as the final fan is seldom required under most operating conditions.

While the benefits to be obtained from providing better working conditions within the engine compartment are not of a nature that can be measured concretely, they are none the less obvious. Everyone can work better when he is comfortable, and reasonable comfort is essential for thorough work. While on steam locomotives the mechanic was apt to skip some part of the work when working conditions were bad and it was far from a good thing, the consequences were trivial compared to what can happen when even a small job is skipped on a Diesel. With a precision instrument such as a Diesel locomotive, no opportunity should be overlooked for doing all the work needed in the best manner. It is for this reason that serious consideration should be given to all methods for improved ventilation in hot weather, and to any other reasonably attainable improvement in comfort.

Shrinking Sources of Supply

In the railroad business one of the cardinal principles is the premise that service is to be maintained at all times and, in emergency at least, at any cost. In over a hundred years of operation this principle has been maintained with respect to maintenance materials and parts by establishing in the railroad set-up the necessary personnel and facilities to make the parts needed to keep trains moving or else to assure themselves of a sufficiently broad base of supply sources that no single stoppage of supply, either of materials or fabricated parts, could operate to make necessary a serious curtailment of transportation service.

In these days of centralized control of labor and the ability to tie up basic supply groups through strikes many railroad men are raising questions as to the wisdom of abandoning the self-protection principle of the railroad's own shop in favor of the apparent economy of turning to outside manufacturers for the major part of the assemblies and parts needed to maintain continuity of service of cars and locomotives.

There is nothing new in the principle of buying instead of manufacturing parts for it has been followed to some extent through all the years that locomotives and cars have been in operation. The safety in past experience was that there were a great number of supply sources with which the railroads were able to deal directly and assure themselves of filling their needs on bargaining terms. The establishment of central sources of supply through which the products of several hundred manufacturers reach the consumer appears to be the type of concentration that would make it possible for a single labor disturbance, or the emergency of war, to tie up railroad service rather completely.

This is not entirely an academic question. It is one the effect of which the railroads may soon experience.

Axle Failures

The merits of magnetic particle testing of axles at periodic intervals are generally recognized and, in fact, this modern test method is specified in the A.A.R. Wheel and Axle Manual, Supplement No. 1, as a mandatory requirement for all second-hand freight-car axles before remounting.

A single illustration will serve to demonstrate in striking fashion the practical value of this practice. On one Class I railroad, for example, 8,812 axles were Magnafluxed in 1949, surface stress cracks being found in the wheel seats of 967 or 11 per cent of them. The cracks were so deep in 47 of these axles that they could not be turned out within size limits and the axles were scrapped. Eleven axles in addition were found to have cracks in the journal areas and had to be scrapped.

It is not argued that magnetic particle testing will eliminate failures, since, with the millions of axles in service daily on railroads of this country, a few defects are bound to escape detection or develop for one reason or another and fail in the interval between tests. The figures cited, however, show what an effective job can be done in weeding out potential failures and also getting maximum safe service life out of axles with minor surface cracks which can be turned out.

Another aspect of axle handling which deserves the closest attention of mechanical department supervisors and repair forces is the possibility of accidental contact of autogenous welding or cutting equipment with axles thus causing intense localized heating in some spots, progressive fractures and axle failures. Indicative of the lack of full appreciation of this potential hazard is the fact that an inspector at a large car-repair point recently found shop men placing car parts to be welded or cut up for scrapping on the axles of mounted car wheels which were rolled close together and supported the work at a convenient height for welding or cutting. Damage to some

of the car axles was almost sure to result from this practice.

In another case, a road reported to the A.A.R. the occurrence of four derailments in a two-year period due to broken car axles which were fully up to all material specifications, but which failed because of localized overheating and resultant progressive fractures. The lesson from this is that, when necessary to use autogenous welding or cutting of any kind in close proximity to railway equipment axles, whether locomotive, passenger-car or freight-car, the wheels and axles should be adequately protected against accidental intense heating at any individual spots. Covering the parts with asbestos board or heavy asbestos paper with a suitable air space between will generally serve this purpose.

The One-Hoss Shay

An illustrated news release issued recently by the General Electric Company tells of two electric generators which have been in service since 1899. They provide auxiliary electric power for a hospital and are used alternately throughout the 24 hours each day. The only maintenance work required by these machines was done when the commutator of one of the machines was turned 10 years ago.

The life built into these machines was probably ideal for this installation. They are highly efficient even though their sizes are respectively only 30 and 60 kw. This is probably more than can be said of the two steam engines which drive them, but the use of the engines may be justifiable, if the primary use of steam is for heating and the electric power is a biproduct which also assures the continuity of service so important in a hospital.

Some electric locomotives have shown almost equally good performance. In spite of the relatively rugged duty they must perform, original traction motors are still in service on some of the early electrified lines. Such modern recommended practices as impregnating and baking have never been used, and maintenance consists for the most part of blowing out dirt, applying air-drying varnish and perhaps turning commutators and restoring worn brush rigging.

Such examples automatically raise the question, "Why can't we have long life and little maintenance such as this on our present Diesel road power?" A part of the answer becomes apparent when it is realized that the duty cycle on some of these early installations is very light. When their maintenance costs are compared with those of Diesel power on a mileage basis, they do not show up very well. They might make a better showing if they could run farther, but, after all, it is work done which wears out a machine. Rate at which work is done also has its effect on wear and fatigue.

Early operators of Diesel road power suffered from many traction-motor failures. A large percentage of these were traction-motor bearing failures. Some of this was due to faulty bearings, and some to inadequate lubrication and some to poor maintenance. Now nearly all of these bearing failures have been disposed of. This has been accomplished by better bearing metals, improved designs, larger bearings, and greatly improved lubrication and maintenance procedures.

A traction-motor bearing is still a highly stressed part. At present most railroad operators replace them with new or reclaimed bearings at each overhaul period. Only a few inspect and replace bearings which pass inspection.

With the aid of high-temperature insulation and improved design, motor capacities have been increased close to the limit of what can be delivered to the rail by a driver. It raises the question of whether or not some added space might be allowed for bearings with overall economic advantage.

These questions of give and take concern all parts of a locomotive. If we could reach the ideal, a locomotive on the day it was made obsolete by a new design, would automatically, like the One-Hoss Shay, fall into a heap of scrap of just the right sizes for the blast furnace. This is, of course, impossible of accomplishment, but if design can move in this direction, and toward simplification rather than complication, the place of the Diesel in railroad service seems assured for a long time.

BOOKS

HEATING, VENTILATING, AND AIR-CONDITIONING FUNDAMENTALS. *Second Edition. By William H. Severns and Julian R. Fellows. Published by John Wiley & Sons, Inc., New York. Price, $6.50. 649 pages.*

This is the second edition of a text designed to present the essential fundamentals of heating, ventilating and air conditioning. In spite of the fact that heating and air conditioning methods are in a constantly changing state of development, the fundamentals remain practically the same—the methods of application and the equipment available have changed in recent years. This book includes 20 chapters dealing with the broad subjects of heating, ventilation and air conditioning with related chapters describing equipment available and the method of its application. The book includes the latest and most authentic data known at the time of its preparation and along with the applicable theory, examples are given of typical calculations where they add clarity to the presentations. Representative commercial equipment has been illustrated and described and sufficient data pertaining to part of it are included as an aid to design.

SHOPS AND TERMINALS

Road Troubles On Diesel-Electric Power*

By F. E. Stubbs†

FAILURES fall into two general categories—those caused by improper maintenance, lack of maintenance or faulty parts; the other those that are inherent in the equipment and may be due to design and engineering. There is a third category that should have been included—man failures. These latter failures occur occasionally but the situation is being improved all the time through efforts of school cars, road foremen and instructors.

The first type of failure is being overcome by training maintenance personnel. We use the same mechanics for this more highly skilled work that were with us on steam work. That they are doing a good job will have to be admitted by all who know the complications brought about by this drastic change. Nothing but time, proper instruction and close supervision will improve the maintenance problem. You all have maintenance problems that cause road troubles and failures.

The second category gives more concern and will be discussed at length. The inherent troubles, of the third category, are mostly in the electric control system. They show up first in one place then another, first under one circumstance then another. We do not know where the next one will be but we do have a fair idea of its nature. It will probably be an open coil, a burned contact tip, a stuck relay, a contact tip or finger out of adjustment, a shorted set of interlocks or perhaps a bad control jumper cable.

One of the above should really be criticized, and that is, namely—"a stuck relay." It is ridiculous when you stop to think about it, that we would try to operate locomotives with relays or contactors that are so delicate they will not close until you tap them with a pencil or a feather duster, whichever happens to be handiest.

The electric control system is made up of a number of main circuits, a large number of sub-circuits, switches, relays and contactors. They are all in use when the locomotive is in operation, most of them fail at one time or another. We have had failures caused by the fuel pump contactor, the E R relay, the P C relay, the compressor contactor, the field loop contactor, the ground relay and many others, and also the control cable jumpers. When four units are used to make up a locomotive you have four times the potential trouble and that is what I call high potentiality.

Most of these contactors or relays that give trouble are not supposed to require any maintenance. A lot of them are sealed with glass covers and no one gets into them—they do not fail from long use or wear—yet they fail.

As to the control system, when four units with dynamic brakes and automatic transition are operating together, there are approximately 600 contact interlock and jumper points. This does not include main switches and fuses.

For an illustration of what these inherent troubles mean, let us suppose that we are operating and maintaining 50 units—and in the course of six months we have 30 delays or failures. We will assume that ten of these came in the first category, which was maintenance or defective parts. The remaining 20 came in the second category. The boss does not like 30 failures in six months. The fact is, he does not like *one* failure and he does not fail to let you know it. What are we going to do?

I think we need some drastic remedies, something more fundamental than changing a relay that has failed for another one just like it.

We have a good, well-built engine with almost perfect load control for practical use. This engine is mounted on a chassis of great strength which in turn sits on a strong, heavy truck equipped with steel wheels, smooth-rolling, trouble-free roller bearings and powerful traction motors. These powerful traction motors are driven by a more powerful generator which is connected to them by well-built, sturdy and dependable power contractors and reverser. The traction motor blower fans and radiator cooling fans are driven by the best type of electric motor known. The throttle is strong and dependable.

* Excerpts from the proceedings of a meeting of the Southeastern Railway Diesel Club

† General Diesel supervisor, Southern Railway

The air brake equipment is good, although it is not perfect; the sanding equipment is good, even the horn is good. All this, combined with the inherent troubles, give us "an all-powerful giant" with a highly sensitive mind and a serious case of neurosis.

This giant that costs one hundred and fifty thousand dollars, sensitive mind, nerves, and all, could be considerably improved for dependability at small cost.

Even though we are stuck with this control equipment, we do not have to stay stuck with it. The locomotive builders or electrical equipment manufacturers can make control equipment that would compare in quality, sturdiness and dependability with the mechanical equipment. There have been a lot of electrical controls that wore out many stationary engines and air compressors. These controls on stationary plants were more rugged in appearance than the ones we are using on rolling equipment—yet the rolling equipment should require the strongest made.

We do not know from one electrical failure to the next where or what it will be; but we do know of the potential, therefore, we must start reducing this potential wherever and whenever we can. If there are any relays or interlocks that are not absolutely necessary they should be removed. If the coils of these relays and contactors do not have enough magnetic pull, it should be increased. If the wire these coils are made of is not of sufficient strength and capacity, larger wire should be used. If hinge pins or armatures hang and bind, they should be improved. Let us have a relay or contactor that closes with a snap, with plenty of wipe and contact surface, let it be trouble-free, remove these inherent troubles.

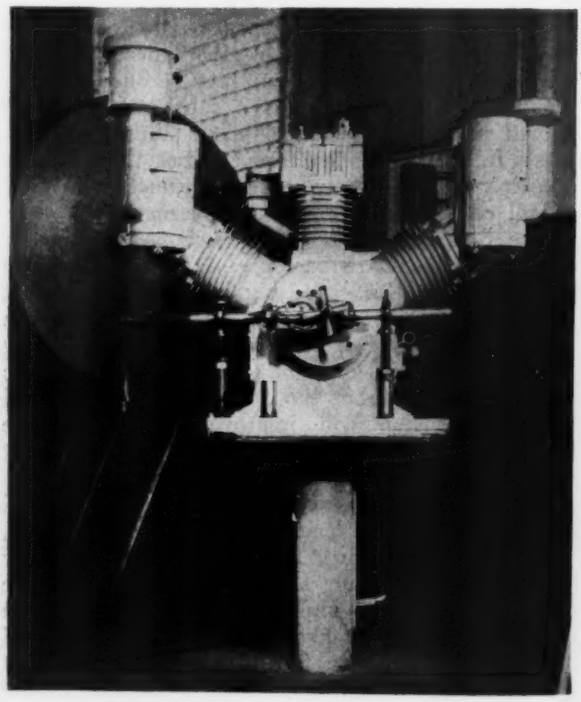
There is one particular point we would like to bring out and that is, the larger the job to be done, the more dependable the electric equipment is. Equipment designed and used to handle high current is better built and more dependable. This is consistently true from the high current carrying reverser, power contactors and cam switches and so on down the line, the starting contactors, battery charging contactors, shunt field contactors, battery field contactors, dependability diminishing all along until we reach the control relays and interlocks which we consider the rock bottom of low dependability.

For a token contribution to this complicated nerve system, I would like you to consider the following: Instead of having one control jumper cable between units we could have two, yet have the same number of plugs and receptacles as we have now, just by using about six feet of cable and one strain relief bushing for each unit. This could be accomplished by removing the cable from the present plugs and receptacles; by using about six feet of cable to each plug and leaving one end of the cable free. Drill a hole beside the receptacle large enough for a strain relief bushing to fit the cable. Then fasten the wires of the free end of the cable to the same terminals that the wires of the receptacles fasten to. We would then have just half as many connection points as before and will have one hundred per cent protection on them.

Break-In Stand For Air Compressors

Every compressor receiving an overhaul should have a break-in period before being applied to the locomotive. The photograph shows a flexible stand which can be constructed to the size needed for any type of compressor used on Diesel locomotives. The base or support is made from an 8-in. pipe with a roller bearing inserted in the top for the table to revolve. An air motor can be connected, by flexible coupling, and the compressor operated until the valves, rings, bearings, etc., are properly seated.

A compressor mounted on the stand ready for the break-in run



Jigs for Connecting Rods

There have been a number of jigs developed for assembling and dismantling Diesel engine connecting rods. The one shown in the photographs was built in the Baltimore and Ohio shops and is for use on Alco and Baldwin engine rods.

The jig is constructed from 1¾-in. by ¼-in. angle iron and can be either bolted or welded in structure. Fig. 1 is an end view showing construction of the frame. The chain at the upper portion is a safety to keep rod from falling from the bracket. In Fig. 2 showing the construction of the frame, it will be noted that two pieces of oak wood

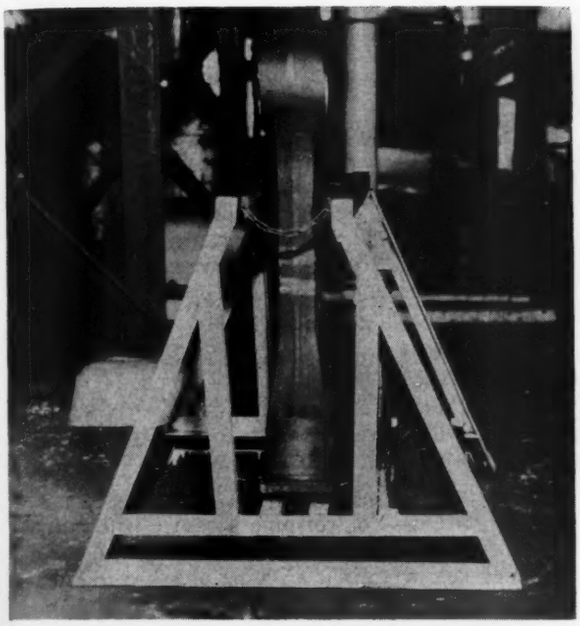


Fig. 1

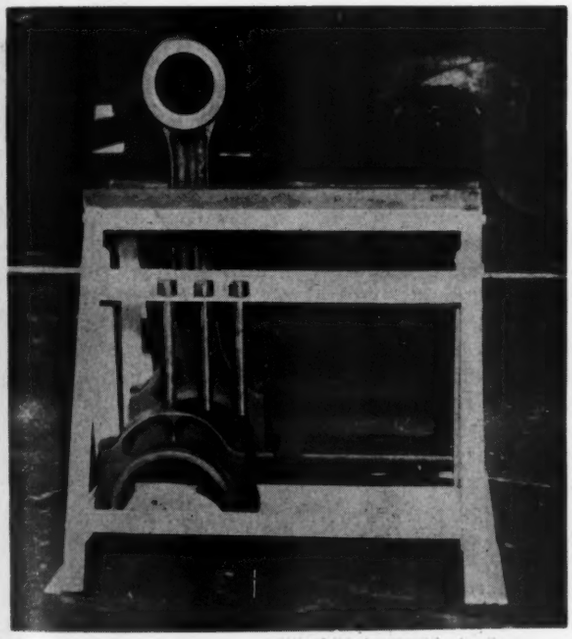


Fig. 2

are fastened to the top angle. This is to protect scoring the piston both in application or dismantling. On the bottom rack, two bushings consisting of 1½-in. S.A.E. thread are welded to the angle bars. Inserted are 1½-in. studs with a welded wheel which is used in adjusting the height in removing the wrist pin from the piston. The extra shelf shown in both views is for storing the bottom half of the connecting rod to insure that both the top and lower half bearing caps always mate. The stud protrudes through the wheel, a portion of which is turned to 1⅜-in. diameter. On this portion a plate ½ in. by 14 in. by 8 in. with countersunk hole drilled 1 7/16 in. is placed and riveted over to hold plate secure. This plate should be free to run on upper portion of the wheel. A fibre pad of ⅜-in. thickness is riveted to the plate to protect scoring end of connecting rod.

The procedure is as follows: (1) Place assembly with connecting rod bearing face rested on bottom of adjusting plate; (2) Adjusting lower wheel until piston rests level on oak board on top angles; (3) Piston and rod are now supported allowing wrist pin to be free; (4) Push out wrist pin.

If the assembly is cold heat may be applied by using steam before dismantling which will allow the wrist pin to be removed more freely.

In the application of the wrist pin, the same procedure should be followed aligning the wrist pin hole with the connecting rod and piston then inserting wrist pin to the piston.

Schedule 24RL
Air Brakes

Electro-Pneumatic Brake Operation

922-Q.—What is the connection to these wires? A.—They are connected to the application and release magnet valves of the No. *21-B* magnet bracket.

923-Q.—What operation takes place at the No. 21-B magnet bracket? A.—The armature of the magnet is pulled down against spring pressure beneath the valves. Release magnet valve *62* is seated and application magnet valve *34* is unseated.

924-Q.—What occurs with the movement of these valves? A.—With the release magnet valve seated, the straight air pipe exhaust passage *X* in the magnet bracket is closed off and with the application magnet valve unseated, passage *6a* is opened to passage *4b*, allowing auxiliary reservoir to flow to the straight air pipe, building up the straight air pipe pressure.

925-Q.—What controls the flow of auxiliary reservoir air to passage 6a? A.—Cut-off valve *5* of the No. *21-B* magnet is held unseated by spring *17*, permitting auxiliary reservoir air to flow to passage *6a* as long as auxiliary reservoir pressure exceeds approximately 75 pounds, which is the valve of spring *10*.

926-Q.—What is the function of the cut-off valve? A.—In the event of straight air pipe breakage or abnormal magnet valve operation, which would result in loss of auxiliary reservoir air, spring *10* will seat valve *5* and thus retain 75 pounds auxiliary reservoir pressure.

927-Q.—What is the purpose of retaining 75 pounds in the auxiliary reservoir? A.—To retain sufficient air to permit an effective pneumatic brake application.

928-Q.—What insures the use of the pneumatic feature during the electro-pneumatic brake operation? A.—The brake valve rotary valve *216* remains in

charging position. The brake pipe pressure is higher on the face of the control valve service piston during electro-pneumatic applications than auxiliary reservoir pressure back of the piston, as auxiliary is reduced into the straight air pipe at the No. *21-B* magnet valve. Consequently, the service piston remains in release position during the electro-pneumatic service brake application.

929-Q.—What other connection is made to the master controller? A.—The straight air pipe is connected through choke *11* to chamber *A*.

930-Q.—What is the purpose of this connection? A.—Air in chamber *A* acts on release diaphragm *18a* in opposition to control pipe pressure in chamber *B* acting on application diaphragm *18*.

931-Q.—What results from the air being balanced against both diaphragms? A.—Spring *23* moves the diaphragm, shaft *32* and lever *40* to Lap position.

932-Q.—What happens in Lap position? A.—The application wire contact (Appl) is broken, the application magnet circuit is thus de-energized and spring *35a* closes application magnet valve *34* of the No. *21-B* magnet.

933-Q.—How does movement of the diaphragm and shaft affect the position of the release valve? A.—Spring *24* of the master controller remains compressed, so that the release contact (Rel) remains closed, energizing the release wire and *21-B* release magnet, holding release magnet valve *62* seated, retaining pressure in the straight air pipe approximately equal to that in the control pipe.

934-Q.—What happens if control pipe pressure is increased? A.—If pressure in the control pipe is increased by further brake valve handle movement, straight air pipe pressure is increased an equal amount by the application operation of the master controller.

935-Q.—What other connection does the straight air pipe make? A.—The straight air pipe also connects to connection *8* of the control valve.

936-Q.—What results from this connection? A.—Air from the *21-B* magnet valve flows through pipe *8*, passage *8* through a cavity in slide valve *226* and passage *8a* to the top of the double check *252a*.

937-Q.—Describe the action further. A.—Lower check valve *252* is seated, sealing off passage *3*, which is open through the cavity of release slide valve *114* to exhaust passage *10*, and unseats upper check valve *252a* so that air from the straight air pipe flows through passages *28*, *36* and *16* to the relay valve.

938-Q.—After making a brake application, how is the braking force reduced? A.—By moving the brake valve handle toward running position, and fully released by placing the handle in running position.

939-Q.—Explain the operation as the brake valve handle is moved toward running position. A.—Cam *254* moves away from floating lever *333* of the self-lapping unit. The lever then pivots on closed inlet valve *315* and the discharge valve spring *328* moves the discharge valve *329* away from its seat.

940-Q.—What flow of air results from the discharge valve being unseated? A.—Control pipe air (pipe *11*) is connected to atmosphere through the brake valve exhaust port.

941-Q.—When the brake valve handle is only partially moved toward running position does control pipe air release entirely? A.—No. Control pipe air in brake valve cavity *Y* and acting on the piston type discharge valve seat *322* will be partially reduced and regulating spring *321* will move the seat into contact with the discharge valve, which prevents further flow of air from the control pipe.

942-Q.—What happens when the brake valve handle is moved to running position? A.—Cam *254* is moved away from the floating lever and the discharge valve spring holds its valve *329* open to vent all pressure from control pipe *11*.

943-Q.—What results from reduction of air in the control pipe? A.—Control pipe pressure in chamber *B*, acting on diaphragm *18* of the master controller is reduced below straight air pipe pressure in chamber *A* on the face of the release diaphragm *18a*.

Fairbanks, Morse Diesel Locomotives*

Q.—When a fuel dilution is reported in crankcase oil, what should be done to correct this condition?

A.—It is first necessary to locate the cause of the dilution. Continued idling of the engine will cause dilution as all of the fuel is not burning in the cylinder and consequently drains into the crankcase. Low operating temperature will prevent the unburned fuel in the crankcase from vaporizing and the dilution will remain. Poor injection caused by defective nozzle will result in dilution and can be corrected by replacing the nozzle. Much dilution is caused by leaking connections. Ordinarily, dilution will be negligible if the engine is operating above 170 deg. F.

Q.—What is the highest percentage of dilution which can be tolerated for regular service without decreasing the lift of the bearing appreciably?

A.—I recently spent two hours with oil company representatives discussing the limits of dilution and no definite conclusions were reached. Too much dilution will result in a crankcase explosion if a spark occurs to ignite the crankcase vapors. This spark could be caused by metal to metal contact or possibly a combustion leak. One road had a practice of draining diluted lube oil. Despite this precaution explosions continued to occur, indicating that it is not the lube oil but the fuel oil vapors which cause the explosion. A limit of 5 to 8 per cent is now believed to be the practical limit.

Q.—How would you overcome a crankcase of dirty black oil after machine change, oil change, engine air filter change and intake and exhaust port scraping?

* These questions and answers were submitted following a talk at a meeting of the Chicago Railroad Diesel Club by E. T. Caldwell, Fairbanks, Morse & Company, on the opposed-piston engine.

This occurred on a road locomotive after one trip after an oil change. The condition also existed prior to the oil change.

A.—Probably the oil bypass valve is set too low which would allow the oil to circulate through the engine and not through the oil cooler or it could be a faulty drain back valve to the filter.

Q.—What should be the operating temperatures of engine cooling water and lube oil in the 1,000-hp. switchers? How important is it to maintain correct temperatures? How much variation should be allowed?

A.—An operating temperature of 160 to 165 F. should be maintained on the engine cooling water outlet. The oil outlet temperature should be maintained in the 165 to 170 F. temperature range.

Q.—Why is there a valve in the crankcase return oil line from the servo motors on the 1,000-hp. switchers?

A.—Should any part of the equipment be removed, this valve can be closed and the part removed without draining the crankcase. This valve gives considerable trouble and has been removed on late production locomotives. Where used, this valve, should be wired in the open position.

Q.—What is the cause of fuel injectors becoming gummed up when the engine has been idling for five to six hours?

A.—It can be traced to the fuel oil. With the proper fuel there should be no trouble with the injectors.

Q.—If tool marks are worn off and piston rings are smooth, are the rings considered worn beyond further use?

A.—Many pistons which have gone 200,000 miles still retain the tool marks on the rings. If the tool marks are worn off the rings, the rings should be discarded.

Q.—Give the lube oil pressure of high and low or idle speed and low oil shut down pressures. Engineers are continually complaining about low oil pressure...

A.—On road locomotives the pressure should range from 8 to 10 lb. per sq. in. at idle speed and 25 to 27 lb. per sq. in. at full speed. These pressures are measured at an upper point on the header. Our low oil shut down pressure limit is 5 lb.

Q.—We have several reports of engines stopping on the road and the crew being unable to start them again. After a lapse of several minutes the engine will start. What was the cause of the engine stopping?

A.—Several things could have caused this behavior. The engine dying could be caused by a defective clutch coil which would allow the governor arms to part, thereby shutting off the fuel and causing the engine to stop. Another possibility is that the 5-pound low oil pressure switch could be open and cause the engine to shut down. If the red engine stop button is pushed, causing the engines to stop, it is necessary to turn the engine to off before attempting to start. If the engine is operating on a heavy assignment the oil viscosity will be reduced because of the increased engine temperature. This will cause the engine to shut down if the switches have not been properly adjusted.

Q.—Has Fairbanks, Morse considered covering the voltage regulators and load regulators on the early switchers to avoid loss in power or poor voltage control?

A.—The load regulator consists of six discs which should have a resistance of 2 or 3 ohms when compressed. Road dust, however, will cause an oxide to form on these plates and increase the resistance which will increase the exciter field current thereby making it impossible to obtain the top no-load voltage. To correct this condition, covers have been applied on later equipment. Although most trouble can be directly traced to improper maintenance, covers for both the voltage and load regulators are recommended.

Q.—Is there any kind of power driven tool which can be used for cleaning carbon out of cylinder liner ports?

A.—There are many cleaning devices. Most roads employ a power-driven brush to clean the liners when they have been removed from the engine. Although power driven tools do a fast job in cleaning liner ports while the liners are in the engine, we do not recommend use of them as they are prone to allow the loosened carbon to enter the combustion chamber.

Q.—Should liners be honed when a lower piston is changed? How can this be done without removing the upper crankshaft? Do you recommend honing liners when all pistons are reconditioned?

A.—When only one piston is changed honing is not required although it does help the seating of the rings. If possible the same rings should be reapplied in their original position. Naturally, when all the pistons are being reconditioned, the liners should also be honed.

Q.—Why is it necessary to examine No. 5 and No. 8 main bearings more often than the other main bearings?

A.—The cylinder adjacent to the No. 5 and No. 8 main bearings are timed to fire relatively close together. As a result of this, the thrust balance is not perfect and accordingly there is a tendency to throw the crankshaft against these main bearings and increase the possibility of wear on these particular bearings by wiping the oil film from the bearing.

Q.—What are the proper full load fuel rack settings for a 2,000-hp. and also for a 1,000-hp. engine?

A.—The total setting should be equally divided between the governor side and the engine side. On the 1,000-hp. switcher, for example, the full load rack setting of 14 mm. should be divided so that there is 7 mm. on the governor side and 7 mm. on the engine side. On the 2,000-hp. engine, the total rack setting of 15.3 at full load should be divided so that there is 7.6 mm. on one side and 7.7 mm. on the other side. A similar procedure is employed in dividing the fuel load setting of 14.5 mm. which applies to the 8 cylinder, 1,500-hp. engine.

Q.—What is the quickest way of checking fuel rack settings on a Fairbanks, Morse road locomotive to be sure that it isn't overloaded?

A.—By observing the exhaust gases coming from the stack. If the setting is correct the stack should be clear. Another quick check is the engine speed. If the speed is normal and the stack is clear it is a good indication that the engine is not overloaded.

Changes in 1950 Interchange Rules*

By T. J. Boring†

FREIGHT CAR RULES (*Continued*)

Rule 49

Sec. (*c*)—Modified to provide more specific and standard locations for cardboards for bad order, routing and return cars, etc., all-steel house cars.

Rule 60

Sec. (*f*)—More care should be exercised in removing all old air brake cleaning marks, by scraping off before painting over with quick-drying paint, preferably black; also in recording the old markings. Failure to do so results in claims for refunds under Sec. (h). The same care is also necessary for same reason in the recording and removal of old stencil markings for repacking of journal boxes, and application of the new stenciling.

Sec. (*L*) *New Note 5*—Added in Supplement No. 2, effective August 1, 1949, to provide for mandatory renewal of the following parts regardless of condition, which AB brakes are given periodical attention:

Back cover gasket....Pc. No. 94841 or CV-115
Ball check cover gasket.Pc. No. 94873 or CV-106
Service valve cover gasket .....Pc. No. 94899 or CV-149
Quick service limiting valve diaphragm....Pc. No. 94887 or CV-155

These renewals are made at central air brake shops on all AB brake valves cleaned and repaired as the allowance of $20.43 shown as Item 15 or Rule 111, has been increased to include the cost of these three gaskets and one diaphragm renewed. Same applies to AB-1-B brake equipment.

Rule 66

Sec. (*d*)—Modified to provide for reference to the new Lubrication Manual which is being issued separately in pamphlet form and replaces that portion of Rule 66 formerly titled "Journal Boxes, Standard Method of Packing—Standard Practice," which has been eliminated.

Interpretation No. 4, Approved Packing Retained Devices—Note following same modified in regard to location of the 1½-in. square solid white block used in the stenciling to indicate that car is so equipped. Note now reads in part "*stenciled in close proximity to repack stenciling*" instead of "stenciled under the word REPKD. We find that where the A. A. R. Standard two-line stenciling is used, this white block can best be located under the word REPKD as on P. R. R. cars. This white block must be maintained when the stenciling is changed or renewed. The Hold-Rite spring type packing retainer is an A. A. R. approved type, and is being applied to all friction bearing journal boxes on P. R. R. freight and passenger equipment cars. Many cars of other ownerships have also been recently so equipped.

This Interpretation No. 4 had been modified in Supplement No. 2 effective for repairs made on and after August 1, 1949 to make the repairing line responsible for re-application of these devices, if in serviceable condition, or issue defect card, when removed account of R & R or R of wheels, truck sides, bolsters, journal boxes, friction journal bearings or wedges, or in connection with repacking of journal boxes. Defective or missing Approved retainers should be renewed in kind if standard to car. Initial applications are to be made only by car owner.

The heading GENERAL under Rule 9 had also been revised, to require that Billing Repair cards covering above repairs must show whether or not car is equipped with these retainers. This can readily be abbreviated and if they are removed and found OK and reapplied, R & R should be added. If defective or missing and not renewed, the repair card should so state. This applies of course whether or not the stenciling includes the white block.

Rule 70

New Sec. (*g*)—Added to provide that road issuing defect card for cut journal must assume charge for difference in value between one-wear wrought steel wheels (new, secondhand or turned)

* Abstract of a discussion of the changes in the 1950 Interchange Rules presented before a meeting of the Eastern Car Foremen's Association, New York, February 10, 1950. The first part of this abstract appeared in the April issue

† General foreman, M. C. B. Clearing House, Pennsylvania

applied by intermediate road in place of serviceable cast-iron wheels standard to car.

Rule 87

Interpretation No. 1—Modified to clarify the intent that splicing of *wood* sheathing shall be considered as temporary repairs in all cases.

Rule 93

First requirement of third paragraph—Modified to provide that charges for different months may be shown on same bill statement provided they are grouped and totaled separately for each month.

Third requirement of third paragraph—Modified to make it optional as to whether separate statement is furnished for periodic repacking of friction type journal boxes and lubricating journal roller bearing units when these charges are shown on separate billing repair cards.

Rule 95

First paragraph—Modified to provide that labor *and the difference between new and second-hand value when new material is applied*, is chargeable to car owner for replacing couplers, yokes, springs, followers, draft gears, when lost on the line of the company making repairs and the condition of same is unknown.

Second paragraph—Modified to include *yoke rivets, end filler* and rivet when lost with coupler, etc., as above.

Last paragraph—Modified to include high tensile ("H T") type E knuckle and lock in provisions of this paragraph.

It is important to develop whether car bears stenciling, or how opposite end of car is equipped when replacing such items which have been lost and show this information on billing repair card per last paragraph of this rule.

Rule 98

Sec. (c-7)—Modified to provide that A. A. R. X.-1 cast-iron wheels of 1947 design modified with respect to hub location and length and cast subsequent to 1946, take the same status as the A. A. R. Recommended Practice cast-iron wheels, as to charge, credit and mounting.

Sec. (f-4)—Modified to provide for same billing procedure as outlined in this paragraph, when 1-W W S wheels are substituted for cast-iron, as well as vice-versa, when repairs are made to a foreign or private line car on authority of defect card of another company.

Sec. (i-1)—Increased prices shown for value of service metal of turned 1-W wrought-steel wheels—$3.12 per $\frac{1}{16}$-in. for 50-ton or less and $3.34 per $\frac{1}{16}$-in. for 70-ton wheels.

Rule 101

Material Charges—Price adjustments have been made in line with recent quotations resulting in some small increases and decreases. A resume of 48 of the items most often used in repairs shows that present prices have increased 81 per cent over January 1, 1946 prices. All prices include seven per cent stores expense, 1 per cent interest on stock investment and approximately 1 per cent for commercial and deadhead freight haul. The following principal changes have been made in this Rule:

New Items 101, 101-A, 101-B and New Note following—Added to provide for Wabcoseal fittings, chargeable only where standard to car.

New Item 201—Added to provide charges and credit for 5 by 9 tubular axle.

Item 253-G—Modified to include Miner A-70-XB draft gear.

New Item 254-C—Added to cover the National M-18 draft gear which has been transferred from Section III, obsolete gears, to Section II, non-approved gears. Former Item 254-C renumbered to Item 254-D and Item 270-A eliminated account these changes.

Interpretation No. 5—Modified to make it clear that the former A. A. R. Standard 1921 Specification box lid is referred to hooded type lid with flat spring. *Table* covering *Weights* of *Horizontal Draft Gear Keys* on page 216 modified to show whether used with vertical or horizontal plane yokes.

New table added page 216, listing *A. A. R. Alternate Standard Draft Key Retainers* and A. A. R. Approved Equivalent Retainers and Locks. See comments under Rule 18, new Paragraph (g) and new Note.

A. A. R. Approved Types of Geared Hand Brakes, Page 217—Sub-heading modified to provide that brakes manufactured on or after January 1, 1950, must have Type Designation Drawing Reference cast or stamped on housing. Also, Champion No. 1124 and No. 1148 added to table of Vertical Wheel Type. It is essential to show proper data required by Rule 9 on repair records.

A. A. R. Approved Types of Journal Box Lids, on Page 217—Union Spring and Manufacturing Co. lids added—P. S. Nos. 278 and 282, and composite No. 280 in 5 by 9 and 5½ by 10 sizes; P. S. No. 279 and composite No. 281 in 6 by 11 size. Proper preparation of repair cards per Rule 9 is necessary.

General—This Rule has grown from 13 items in year 1885 to nearly 300 items plus tables of weights, sizes, etc., with combinations. The prices were frozen during the war and considerably increased since due mostly to the large increase in labor costs. Similar changes occurred after World War I. Table III shows the changes in the principal items at six stages since year 1895.

Second-hand prices began in 1887 for wheels and axles, at 70 per cent of value new (scrap at 38 to 45 per cent). In 1897 second-hand prices were established for brake beams, couplers and knuckles at 75 per cent. The percentages have fluctuated since. In 1936, 12 other items at 50 per cent were set up in Rule 104-L, which has grown to present 26 items.

Rule 107

Labor Charges—Due to the increases in cost of

TABLE III—PRICE CHANGES OVER A PERIOD OF 55 YEARS

Year	Forgings	M. I.	C. S.	H. Sprgs.	Chain	Lumber	⅝-in. or over Tot. Rivets	Labor
1895	0.03	0.03	0.035	0.035	0.05	0.025	0.10	0.20
1920	0.05	0.08	0.09	0.05	0.05	0.045	0.16	0.67*
1930	0.06	0.11	0.09	0.045	0.075	0.075	0.22	1.10
1941	0.065	0.075	0.10	0.055	0.08	0.06	0.22	1.40
1948	0.10	0.15	0.15	0.085	0.13	0.13	0.34	2.25
1050	0.11	0.185	0.175	0.095	0.155	0.13	0.42	2.80

10 per cent added to net total bills for 1913
* 30 per cent added to net total bills for 1919 and 1920
Scrap credit per lb.—in the early years this varied from ½ to one cent for different materials, and since 1913 has been ½ cents for all materials except for brass and journal bearings.

labor paid to employes engaged in car repairs, all labor rates and charges in this and other Rules have been increased in proportion, the freight car repair rate per hour increases were as follows:

Employes Increases	A.A.R. Freight Car Repair Rate	Date Effective	Issued in Supplement
7 cents per hour	$2.25 to $2.35	April 1, 1949	No. 1
	Combination allowances	May 1, 1949	No. 1
40-hour work week	Material only prices	Aug. 1, 1949	No. 2
	$2.35 to $2.80	Sept. 1, 1949	No. 2
	Combination allowances	Sept. 1, 1949	No. 2

The following table shows the increases since year 1929:

Labor, Per Hour	8/29	1/38	12/41	2/44	6/46	9/47	9/94
Labor—Freight	1.10	1.25	1.40	1.60	1.95	2.25	2.80
Labor—Passenger	1.20	1.40	1.55	1.75	2.15	2.50	3.10
Labor—Tank	1.25	1.45	1.60	1.85	2.25	2.60	3.20
Labor—Lubr. & Clng.	0.85	1.00	1.10	1.25	1.55	1.80	2.25

Item 84, new Sub-Item (h)—Added to provide charge for jacking car in connection with repairs to coupler draft stops.

Rule 108

Sec. (a), New Item No. 24—Added to provide that no labor charge is permissible for replacing car on center when no worn, broken or defective parts are involved.

Sec. (b), Item 6—Modified to permit charge for lubrication of center plates and friction side bearings as per new Rule 61-c and Item 172 of Rule 101 issued in Supplement No. 2 effective August 1, 1949. This charge may be made only when other repairs are made for which charge is permissible for jacking that end of car.

Rule 111

Air Brake Repairs—Charges increased effective September 1, 1949, in Supplement No. 2 in proportion to increase in labor rate as shown in Rule 107. Items 15 and 15-A (cleaning of AB and AB-1-B brake equipment) revised and increased as result of A. A. R. time items of material as outlined under Rule 60, new Note 5.

Item 3—Modified to include Wabcogrip, Flexigrip and Wabcoseal fittings.

First Note following this Rule—Modified to provide charge for material only, where defective AB type service or emergency portions or pipe bracket is renewed separately and periodic air brake cleaning is not performed.

Rule 112

Settlement for Destroyed and Badly Damaged Cars:

Sec. A—Arbitrary allowances specified in Paragraphs (1-b-3), (1-c-3), (1-c-4) and (I-d) revised account increased labor costs for performing these services in connection with the return home of badly damaged cars.

Sec. B, Reproduction Costs, Paragraphs 1 & H, Prices Per Pound—Were increased on basis of 72,501 new freight cars built during year 1948 effective for cars destroyed on or after August 1, 1949 as issued in Supplement No. 2. These increases were box, flat, poultry and stock cars, 6 per cent; refrigerator, 7 per cent; gondola and hopper, 12 per cent, and tank cars, 27½ per cent.

Paragraph 8, Note 1—Modified to indicate that the settlement for special protective inside coatings to tanks of tank cars applies to initial application only.

New Note 2—Added to provide special settlement for *initial* application of rubber lining to inside of tanks of tank cars.

Paragraph 9, Additional Allowances—These prices were adjusted effective August 1, 1949 in Supplement No. 2 to represent increased costs of same.

Rule 120

Disposition of Cars Requiring Extensive Repairs, Owners, Defects:

Sec. (e) and (f) and Interpretation No. 3—Modified account increased costs for performing these services in connection with the return home or repair of such badly damaged or badly deteriorated cars.

Billing Repair Cards—Forms shown on page 281, 282 and 285. The former "Mall. Iron" column is replaced by "Period. Repkg." column for entering charges for periodic repacking of journal boxes, per changes in Rules 9 and 93. Charges for "Mall. Iron" hereafter will be shown in the "Net Price" column.

Passenger Car Rules

Rule 2

The effective dates of the following Sections have been extended to January 1, 1951:

Sec. (e)—Cardboards or suitable receptacles for Defect Cards and Joint Evidence Cards.

Sec. (f)—Brake Shoe spark shields.

Sec. (c)—Modified to indicate that cars must be equipped with metallic steam heat connectors having *at least* two-inch openings throughout, to be acceptable in interchange. The words "at least" were added to provide for cars equipped with 2½-in. metallic connectors.

Rule 7

Sec. (f-13) Note 2—Modified to provide that effective August 1, 1950, untreated 36-in. multiple-wear wrought-steel wheels substituted for heat treated wheels shall be charged at scrap value and defect card issued for labor only.

Sec. (j)—Modified to provide 24-month air brake cleaning period for D-22 types of air brake control valves. Also provide for cleaning of service or emergency portions of D-22 types separately, if found defective within this time limit, including separate stenciling. A clause reading "on the D-22 types the displacement reservoir diaphragm must be removed, inspected, and renewed where necessary" is added as a requirement before charge is permissible for cleaning such brakes.

Replacement of Armored Type Brake Pipe and Straight Air Pipe Hose—Added on page 327 following Section (j)—These new instructions require removal for inspection of the brake pipe hose and straight air pipe hose at ends of car when the air brakes receive periodic attention, and the removal for inspection of all Armored type air hose on cars given general shopping. All hose thus removed, if to be reused, must be inspected and tested as provided in Paragraph 2 of these instructions which should be carefully studied by all concerned.

Rule 21

Labor Charges—Item 25 modified to indicate that charge applies to all types of axle pulleys R & R or R.

Rule 22

Material Charges—Adjusted in line with recent quotations resulting in some slight increases and decreases.

New Item 1-A—Added to provide charge for flat type, 5-in., 6-ply generator belt.

Item 44—Modified to indicate that vertical type vestibule curtain is intended.

See Page 346 for, "A. A. R. Standard 1940-Design Passenger Car Axles, Designed for Roller Bearings, Having Increased Diameter Wheel Seats."

This new table added, including price Items 61, 62 and 63 for such axles, same now being separated from the combined table of 1940-Design friction and roller bearing passenger car axles shown in Supplement No. 2 of July 1949. This change was due to further studies having shown that present costs of new roller bearing axles, including machining, are much higher than friction bearing axles.

Squeeze Riveter

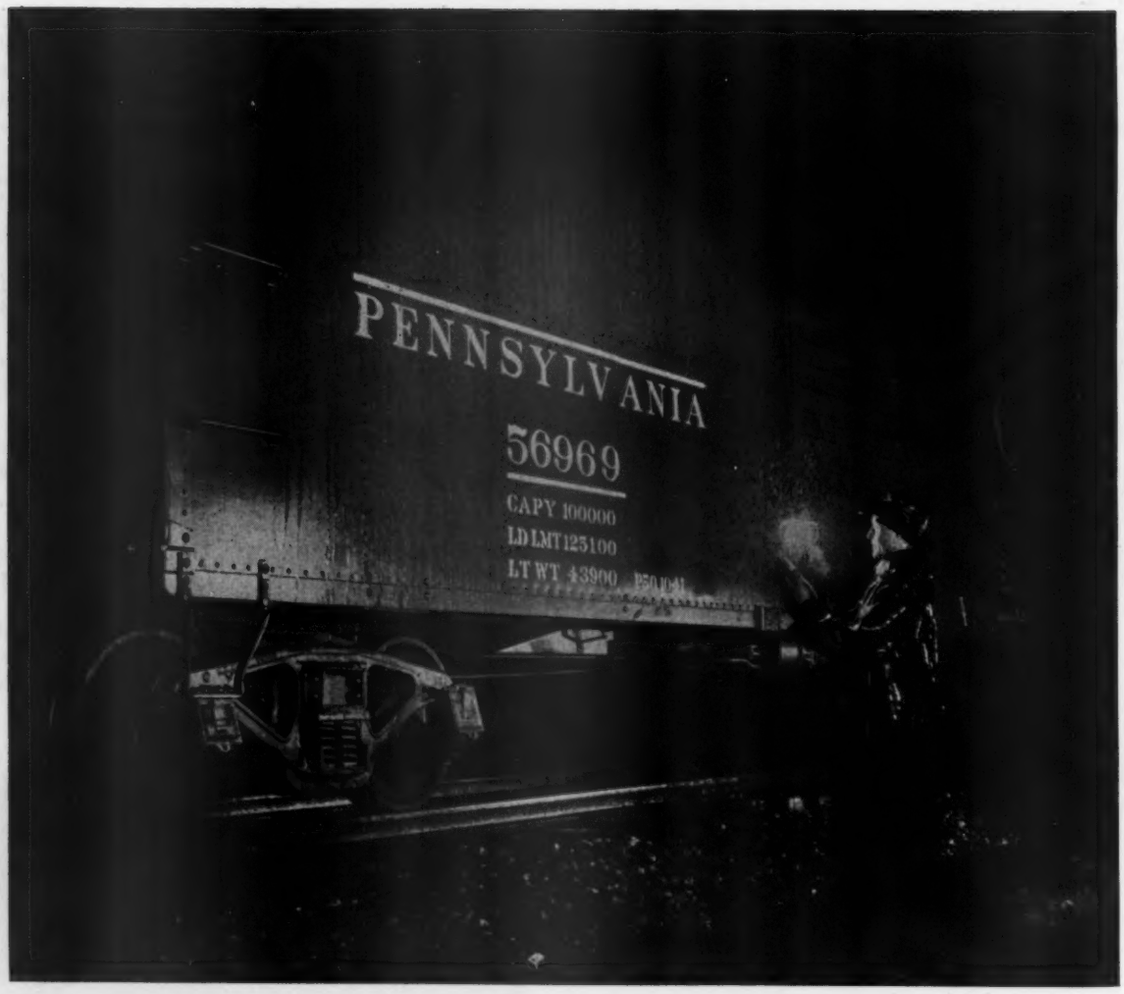
Despatch Shops, Inc., East Rochester, New York, has made two conversions to conventional squeeze riveters to make them adaptable to the efficient performance of a variety of shop jobs. The first conversion changes the riveter into a portable single punch by making a jaw to suit the job. The air cylinder is mounted on one end of the new jaw, which is a C-yoke shorter than the original jaw but with a wider mouth. The punch die is mounted on the other end of the jaw. The end of the piston rod is threaded, and the punch is secured to the rod by a coupling which screws on the threaded end.

As converted the squeeze punch has the capacity to punch an $^{11}/_{16}$-in. hole in $^{5}/_{16}$-in. material. The unit is mounted on a carriage and can be used anywhere in the shop. The carriage includes the hydraulic pump unit and a jib crane with an 8-ft. radius.

The squeeze punch is used for miscellaneous jobs that cannot be punched accurately in the flat because of the distortion which would occur in future shaping. It is used to punch holes in material which is inaccessible for conventional punching after the material has been shaped, such as the rivet holes in crossridge diagonal braces for the rivets that secure the brace where it fits over the crossridge cap.

A second conversion is similar to that just described except for the design of the jaw. This is used on one-piece unit hoppers after shaping to punch the holes in the flange through which the hopper is secured to the center sill. By using this squeeze punch after the hoppers have been shaped a better matching of the holes is obtained than where the punching is done in the flat before the hopper is shaped.

Squeeze riveter adapted for punching holes in material that cannot be punched accurately in the flat because of future shaping and for material inaccessible to standard equipment after pressing



What Do Car Inspectors Do?

They explain their duties at a meeting of Car Foremen's Association of Chicago and discuss some of their problems

ONE of the best monthly meetings held by the Car Foremen's Association of Chicago during the current season was "Car Inspectors Night" on Monday evening, March 13, attended by about 150 car men from the Chicago territory. W. J. O'Brien, general car foreman, Nickel Plate, Chicago, presided. H. L. Hewing, superintendent, Chicago Car Interchange Bureau, spoke on the importance of the Chicago gateway and called on five inspectors to explain the relation of their work to results accomplished.

The panel of Chicago car men included the following: H. W. Baxter, car inspector, A.T.&S.F., Corwith Yard; M. F. McGreevy, car man, Pennsylvania, 12th Street; George Gravenstuk, car inspector, Nickel Plate, Calumet Yard; John Kutlik, car inspector, C.C.I. Bureau Inspection, Stockyards territory; and Elijah Lee, car inspector, C.M.St.P.&P., Bensenville yard. Brief abstracts of these papers follow.

The Chicago Gateway

By H. L. Hewing

Supt. of Interchange
Chicago Car Interchange Bureau

Railroads in the Chicago Terminals area employ over 700 car inspectors whose time is wholly, or in part, taken up with interchange inspection. How many more are utilized on other phases of car inspection work, such as off-line inspection, outbound train inspection, order and commodity car inspection, I do not know.

The interchange inspection of cars, and other details in connection therewith, within the districts of Chicago and vicinity, including the main line of the E.J.&E. from Waukegan, Ill., to Porter, Ind., comes under the supervision, constitution and rules of The Chicago Car Interchange Bureau, the bureau being governed by the A.A.R. Mechanical rules of interchange. The bureau is a part of, and operates under the jurisdiction of the General Managers' Association of Chicago, 37 roads within the districts of Chicago and vicinity being members of the bureau, 21 of these being trunk lines and balance intermediate, switching and industrial lines.

A.A.R. Interchange Rule 2 provides that cars having defects, for which the delivering line is responsible, must be properly carded when offered in interchange, and that the practice of running defective cars on record, and later issuing rebuttal defect cards and transfer authorities to offset similar cards issued at the next interchange point, is a definite violation of the rule. In other words, a receiving road must obtain its protection at the time and place of interchange. The member lines of the bureau, I am glad to say, comply with this rule.

To illustrate the volume of interchange traffic through the Chicago gateway: In 1948, there were 4,328,877 loaded cars interchanged; of this number, only 450 loads had to be transferred from one car to another. In 1949, there were 3,765,168 loaded cars interchanged; of this number, only 280 loads had to be transferred.

In 1948, there were 479,433 car loads of perishable freight interchanged through the Chicago gateway. Of this number, only 181 were delayed for repairs to the extent of not reaching destination about the time intended. In 1949, there were 457,855 car loads of perishable freight interchanged; of this number only 69 were delayed for repairs to the extent of not reaching destination about the time intended.

All of this traffic requires careful car inspection to insure safe train operation, the prevention of injury and lading claims, and should indicate the importance of car inspectors' responsibilities. The small number of complaints which result, indicates that car inspectors are doing a pretty good job.

General Car Inspection

By H. W. Baxter

Car Inspector
A.T.&S.F., Corwith Yard, Chicago Terminal

Car inspecting is one important phase of the car man's trade involving far more responsibility than some men apparently realize, even those doing this type of work. . . . Our jobs are vital to safe train handling, protection of life and limb and safe transportation of commodities in minimum time. How would you feel if some train men were injured or killed on a car you inspected, due to a defect you overlooked in "one lax moment." Little do people realize when they pull up to crossing gates on a highway that they, as well as train crews or passengers, are dependent on inspectors 5 to 200 miles back having performed their duties conscientiously so there will be no accident at that particular place and time.

Proper inspection of freight cars in interchange requires more than a knowledge of car parts and rules. Poor judgment, or a man dishonest with himself, may not only jeopardize life, but cause delays to cars, added handling and loss of revenue. These features are important inasmuch as they are responsible for our type of jobs being in existence today.

Mechanical defects must be detected and corrected because failure of one part of a car or its running gear can cause untold delay. Among the car parts most subject to defects are: Couplers and their attachments, draft gears, yokes, wheels, brake beams, truck sides, truck bolsters, journals, body transoms, center sills, etc.

The physical condition of cars is important in that an inspector must use good judgment in determining if a car is fit for service, and what commodity may be safely loaded in it. Improper carding of a car at this point of inspection requires added handling. I define physical condition primarily in relation to the superstructure and the commodity a car is fit for; however, it also applies to the draft and running gears.

Exterior inspection is essential in that defects to any portion of the superstructure can be a means for allowing the elements to gain access to the interior of a car. Interior inspection is required to make sure a car is fit to take certain types of lading. Some of the most common causes for lading damage are: broken end and side lining, loose, decayed and

broken flooring, blocking nailed to siding and floor boards, contamination, protruding nails, tie bands and wires, etc.

Another major phase of inspection is cardable damage to cars received in interchange. If we view this with a selfish motive then we can say we are protecting the carrier employing us, but our responsibility goes much deeper than that. Carding a car to the repair track for joint inspection and issuing additional defect cards places an inspector in a position where he not only represents his own employer, but also that of two or more carriers. Action in all cases is predetermined by the A.A.R. Code of Interchange Rules.

Open-top cars, as well as house cars, must receive good inspection when empty to determine whether they are fit for reloading, and loads on open-top cars must be carefully inspected to determine if they are safe to leave the terminal.

One way to make us aware of our responsibilities is to bear in mind every time we inspect a car that we are looking at a death-dealing instrument, if we are not conscientious in the performance of our duties. If we take cognizance of these factors, we will be serving our employer well, thereby, reducing train accident, delays, damage to lading and injuries.

Don't forget we are an integral part of a vast transportation system, the only self-sustaining one, and one which is today fighting for its very existence, since public-subsidized transportation systems are jeopardizing the railroads' future and the very jobs we hold.

Outbound Freight Inspection

By Elijah Lee

Car Inspector

C.M.St.P.&P., Bensenville Yard, Chicago Terminal

All 25 of my years of railroad service have been in the car department as repair track laborer, helper and carman, train yard car oiler and finally car inspector at Bensenville yard.

The longer I work as a car inspector the more I realize the importance and responsibilities of the position. There are many phases of car inspection work, together with many rules and regulations one must become familiar with. In fact it is a job one can always learn more about. To become a good car inspector on interchange work requires additional study, and I appreciate the help given by supervisors and the C. C. I. B., under whose general supervision interchange of cars in the Chicago area and vicinity is policed and governed.

As to outbound train inspection, as road trains are being made up from cars received in various transfer pulls that arrive from industries, other local yards in the terminal and in interchange from other lines, after the interchange inspection has been completed, the cars are switched and classified on various adjacent tracks or doubles. While this is being done, the outbound inspectors observe cars for any noticeable defects without getting under or between cars. The car oilers likewise perform their servicing after this switching is performed, and any work that requires journal box jacking is chalked up to be performed after the train is doubled up and under blue-flag protection. After the train is made up and the various doubles made, blue-flag protection is applied at both ends of the train.

We then make final careful car inspection and light repairs that can be made in the yard. We also, at this time, start coupling air hose, starting from both ends of track. Air is generally taken from the yard air line. When car inspectors from opposite ends meet near the center of the train and all hose are coupled, inspectors walk back to their respective ends to take up any air leaks. When this is completed, brakes are set and inspectors again start over the train to see that all brakes apply and adjust the piston travel. Bad order cars and cars with inoperative brakes are set out, after which a release test is made and the train released to the outbound train crew.

Order Car Selection

By George Gravenstuk

Car Inspector

Nickel Plate, Calumet Yard, Chicago Terminal

The selection and classification of cars for loading is one of the most important aspects of a car inspector's duties. If cars are not properly eselected for the commodity intended, the shipment may be delayed enroute on account of being in bad order, or the lading may be damaged, or contaminated. This results in delayed train movement and, of course, may make a dissatisfied customer and a large claim for damage. These are just a few of the results that may occur if suitable cars are not selected for the commodity to be loaded. When a car is classified for loading it should receive what might be called a Class A inspection. This means a close inspection of the exterior and interior of the car. As far as practical, this inspection should be made during daylight hours and care should be taken to see that air and repack dates are in date; also, wheels, draft gears, couplers, brake beams, journal boxes and

contained parts as well as all other parts of the car are free from condemning defects. This should be done to insure the car reaching its destination after loading without being bad ordered for defects which should have been detected when the car was classified for loading.

Car interiors should be thoroughly inspected to see that the floor and lining are in good condition and free from protruding nails or other conditions which might damage sacked or cartoned lading. Roofs need close inspection to be sure they are not leaking, and doors must fit up tight and be operative. Cars selected for merchandise or better loading need special attention in cleaning out all contaminating material from previous loads.

Car inspectors regularly assigned to cars on order can become better fitted for their jobs and more valuable to their respective railroads by visiting various shippers for who they select cars and discussing with them any special requirements. By doing this, they can satisfy shippers better and reduce the liability of cars being rejected. Also, car usage is increased. In this connection inspectors can also perform an important service by making suggestions to shippers on proper methods of loading.

I would like to impress upon all inspectors that the selection of open-top cars for loading should be given just as much attention as other cars.

Many delays result from lading breaking through defective car floors. Also, anchorage, blocking, etc. may pull out where the floor is defective, causing shifted lading. Many serious accidents have occurred due to these conditions.

The methods used by various railroads in the selection of cars for loading may differ. At Calumet yard, our agent furnishes order cards to the order car inspector for various commodities and for various shippers. The inspector then selects cars for loading on the basis of the requirements of the particular shipper. Over a period of years he has learned what each shipper demands, and this experience enables the inspector to do a good job with a minimum of complaint.

Occasionally the order car inspector receives a large order for cars for loading where no particular shipper is designated. In this instance, the inspector selects cars on the basis of his own knowledge and furnishes cars suitable for the loading indicated.

C. C. I. Bureau Inspection

By John Kutlik

Car Inspector

Chicago Car Interchange Bureau, Union Stock Yards

Car inspectors of the Chicago Car Interchange Bureau work in the Chicago Junction and the Chicago River & Indiana yards in the Union Stock Yards area, and act in the capacity of joint car inspectors for all member lines who deliver and receive cars and operate trains in and out of the area. This results in an efficient and economical operation.

In addition to the bureau inspectors being responsible for outbound car inspection, to insure safe train handling of all cars taken out of the area by member roads, including clearance inspection of open-top loads and coupling of all air hose, interchange car inspection is also made to protect the receiving member roads, through defect card protection, for cardable defects at time of delivery of cars on their assigned tracks, also seal records taken on all cars. Another major responsibility of the bureau inspectors is to make up reports of cars received from member lines in this area for interchange to other lines, as well as cars originating at approximately 800 industries located in the area.

A large percentage of loaded cars originating in the Union Stock Yards is perishable, fresh and canned meat and animal products. This is further supplemented by a great amount of car loads of fresh fruit and vegetables out of the Chicago produce terminal, there being instances when some roads run trains off their assigned tracks up to 8 times in 24 hours.

A complete record is made out on Form 151-A covering all cars interchanged. On interchange sheet Form 151-A, the initials and numbers of cars are shown, name of the shipper, destination, contents of car, time of interchange and seal record is taken. . . . Under the heading "Condition of Car" the following information is recorded:

All seals improperly applied, broken, missing, unlocked, etc., are replaced by a C. C. I. B. seal, and a report in duplicate is made out. C. C. I. B. green-colored bad-order return cards are attached to cars found by inspection to be unsafe to go forward, and the yardmaster or conductor is notified to set cars out for repairs.

Cars with defects that are safe to proceed to receiving line, other than safety appliance, are carded with C. C. I. B. bad order cards, and railroads receiving them pass on the defect, or makes repairs. Defects that can be repaired on the interchange track are repaired at Chicago Junction.

C. C. I. B. pool marks are applied by bureau inspectors to all cars interchanged. On refrigerator cars loaded with perishable goods, such as fruit and vegetables, the position of hatch covers has to be shown by abbreviation HCO meaning *Hatch Covers Open,* or HCC, meaning *Hatch Covers Closed.* When loaded refrigerators are equipped with air-circulating fans, with fans in ON or OFF position, a record is taken of the exact position. Empty refrigerator cars found with the lever on the ON position, are set back to the OFF position by a C. J.

yard repairman. If the mechanism is found defective, the car is sent to the connecting line shop for repairs.

All placards, including those coming under I. C. C. specifications, which do not belong on cars, are removed, thus protecting the delivering road, as well as complying with A. A. R. and I. C. C. Rules.

When contents are found leaking from cars, an immediate report is made to the proper supervisor, so that action is taken to prevent further loss. The name of the supervisor and the time the car was reported is recorded.

When coupling air hose, coupling hooks, or irons, are used. They are safe to use, and when men become familiar with them, hose can be coupled just as fast as by the hand method. To my knowledge, no injury has occurred in coupling hose since the coupling hooks or irons, were put into effect in 1934.

Because of the different clearance limits on various receiving trunk lines, it is not possible for bureau inspectors to decide whether open-top loads will pass clearance on those lines, but the bureau inspectors make sure that open-top loads, within prescribed clearances, reach the receiving line safely. Open-top loads with heights in excess of 15 ft. 5 in., or protruding beyond a width of 10 ft., are reported to C. J. or C. R. & I. for their disposition.

Due to the importance of accuracy on the interchange sheets he makes out, a bureau car inspector has to show the exact time of every record he takes, due to large sums of money involved in per diem, claims, etc. Also each inspector must check his watch before going on duty, and if the watch shows a variation of one minute or more from the correct time, it must be corrected immediately.

I have outlined some of the duties that are performed daily by a C. C. I. B. inspector in the Union Stock Yards area, it being understood that in addition he has to have a good knowledge of the A. A. R. Rules of Interchange, A. A. R. Loading Rules, United States Safety Appliances Regulations, the Safety Rules and established safe practices. Above all he must bear in mind that he is representing an organization of many railroads, and at no time shall impartiality be shown, or conduct unbecoming to the bureau or the car man's craft.

Coach Yard Inspection

By M. F. McGreevy

Car Man

Pennsylvania, 12th Street, Chicago

Coach yard employees, such as car inspectors, car men, air brake men, car oilers and coach cleaners are vital in the successful operation of coach yards on the Pennsylvania and I presume on any railroad. I would be amiss if I did not pay tribute, at this time, to the good job this group of employees are doing. At our Chicago coach yard, where 30 or more passenger trains are serviced daily, their movement in a safe and complaint-free manner is to a great way, dependent on car department employees performing their duties well.

A good word should be said for coach cleaners, of which the Pennsylvania employs about 150, consisting of men and women, here in the Chicago Terminal. Their work is not always light and minor as many would believe it to be. Their duties consist of scrubbing and mopping floors, toilet and lounge room, cleaning vestibule platforms and steps, vacuum cleaning all interior upholstery, window washing, both inside and out, icing, watering of cars, etc.

Coach yard car oilers also deserve commendation. They are not always the cleanest-appearing men that you see in a coach yard, but the work they perform is exacting. An oversight or poor workmanship on their part, will contribute to delays, and can contribute to danger of train movement enroute. They must be trained to perform their work properly; good inspection is vital, as is the proper repacking of the friction journal boxes. Dry packing must have the proper amount of specified car oil added; packing with a high water content must be removed and the box repacked; packing retainers must be properly applied, packing spooned down to at least one inch below the center line of the journal.

The car inspectors' responsibility for locating and reporting defects in passenger train equipment is obvious. Safety of the train enroute, especially insofar as having the trucks and running gear in perfect order, depends on him.

Air brake men likewise are indispensable and, regardless of weather conditions they are expected to be and are on the job. So it goes, regardless of the class of work a car department employee performs, he is expected to do his work in a proper and safe manner.

Our railroad is vitally interested in preventing injury to its employees, and consequently has an effective safety program, which I am glad to say, our employees cooperate with fully. We all feel that safety is a major consideration in the discharge of duty.

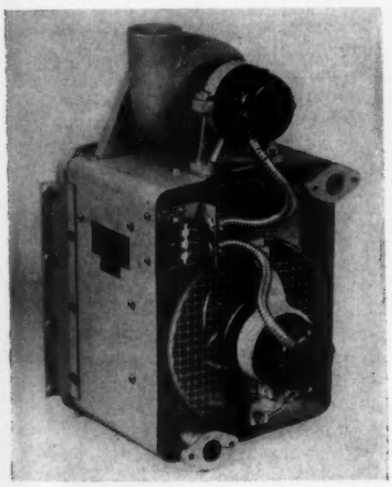
Car men who work under and about cars use the blue-flag and light for protection. With the lightweight passenger equipment now being injected into service, and more appurtenances attached to car underframes, as well as more parts required in the design of car trucks, car mechanics are obliged to spend more time under cars. For this reason, I feel it is in order to advocate additional protection to the present blue-flag and light in the form of rigid-type de-rails.

NEW DEVICES

Cab Heater For Locomotives

The illustrated locomotive cab heater has been announced and produced by Kysor Heater Company, Cadillac, Mich. It can be used either with low pressure high temperature steam or connected to the water supply as a regular hot water heater.

The heater has a unit capacity of 85,000 B.T.U. It provides approximately 700 cubic ft. of 130 deg. F. air per min. to the locomotive cab and in excess of 180 cubic ft. per min. of defrosting air at 130 deg. F. to the windshield.



This heater is of rugged construction and is equipped with a core to permit the maximum heat transfer and yet withstand temperatures under low pressure steam. Its stability is enhanced by its electric terminal blocks and protective conduit that almost completely eliminate electrical troubles.

Nailable Steel Floor For Box Cars

The nailable steel car floor was first developed by the Great Lakes Steel Corporation, Detroit, Mich., for gondola cars where it eliminates the need for two types of cars, one with a solid steel floor and one with a wood floor to which blocking can be secured. It is now being applied to box cars.

Wood floors often present greater problems in box cars than in open-top cars. The increased load capacity of lift trucks has prompted the Association of American Railroads to urge shippers to use portable steel plates laid down on the floor where the trucks operate during loading and unloading operations. This was done to prevent the truck wheels from breaking through the floor boards. To permit nailing into the wood floor permanently laid plates, largely in the door area, were perforated.

Nailable steel box-car floor with indented ribs before the application of the anti-skid plastic

Damage caused by lift trucks handling heavy pallets is shown beyond the steel-floored door area —Indentations in the steel channels are filled with anti-skid plastic

The nailable steel floor for gondola cars consists of channels 8 in. wide by 2⅜ in. deep, with curved webs spaced the diameter of a 20-D nail apart. These are of N-A-X high-tensile steel, 5/16 in. in thickness, and are substantially the equivalent in strength of carbon steel ¼ in. thick.

Trial applications of the channels in box cars were made of the same material, but reduced in thickness to ⅛ in. in order to keep the tare weight down. The concentrated loads on small-wheel lift trucks caused dishing of the plain surfaces of these channels. Furthermore, the plain surfaces were not completely satisfactory in box cars because they tend to be slippery. There is ample beam strength in the webs of the ⅛-in. channels so the necessary surface stiffness was attained by indented ribbing across the channel on 3-in. centers. This provides a surface stiffness to resist dishing nearly equivalent to that of a plain channel of 5/16-in. plate. The tendency to slip is overcome by filling the transverse grooves with an anti-skid plastic.

As in the gondolas, the nailing grooves between the channels are filled with asphalt plastic having an asbestos fiber

The nailable steel floor second deck spans the car without intermediate supports

binder which insures a tightly closed floor. The composition of this material is of the same character as that in use in gondola floors.

Where box cars are fitted with a permanent upper deck for handling heavy products such as farm tractors, the second deck is usually built up with a combination of steel beams and wood and requires portable intermediate supports. These have to be removed and replaced during loading and unloading operations. One-eighth-inch nailable steel channels with webs 2⅜ in. deep have been found to possess sufficient strength to meet the need for a second deck for such loads without intermediate supports.

Industrial Pliers

With the addition of 15 new plier patterns, the J. H. Williams & Co., 400 Vulcan st., Buffalo 7, N. Y., has rounded out its plier line to cover the most popular sizes and styles used in industrial work. The additional styles include the following designs—end cutting nippers; long and short chain nose; long and bent needle-nose; duck bills; round nose; gas and burner; fence and staple puller and battery pliers.

Steel selection, forging and heat-treatment of these pliers is in keeping with high quality standards. All jaw faces are brightly polished. Each pair of pliers is packed in its own attractive box.

Bulk-Material Containers

Two types of containers for handling bulk materials have been developed by the Youngstown Steel Door Company, Youngstown, Ohio. The drop-bottom container permits complete and quick discharge of its contents. It can be used for the shipment of both large- and small-size bulk materials, and has been so designed that the discharge of such materials as ground fire clay and soda ash may be accomplished in a manner which will prevent the formation of injurious clouds of dust in the plant. This is done by setting the container on the floor, releasing the door, and slowly raising the container. While suspended, it can also be discharged by means of a line attached to the release cable.

The drop-bottom container

The controlled-flow container

The container is provided with a locking mechanism which automatically locks the door when the container is placed on the floor. The locking mechanism is so designed that the door is released with the same ease irrespective of the weight of material on the door.

This container is 4 ft. 3 in. wide by 7 ft. long by 6 ft. 5 in. high. The top charging door opening is 2 ft. 11 in. by 4 ft. 11½ in.; the bottom discharge door opening, 2 ft. 9⅞ in. by 5 ft. 7¾ in. The capacity of the container is 145 cu. ft. It weighs 2,050 lb., designed for a maximum load of 16,000 lb. Sides and ends are corrugated sheets joined together by corner angles extending from the base to the top of the container. The discharge door is formed of a corrugated panel reinforced by steel channels. The discharge door is hinged at four points at the rear and supported at the front by the locking mechanism. The container is equipped with cast-steel lifting hooks at the four top corners.

The size of the container permits the loading of twelve containers, two abreast, in a standard gondola car 9 ft. wide.

The top charging doors are of weatherproof design. The doors are locked to the throat of the container by means of a wing nut and eye bolt especially designed for this purpose.

The controlled-discharge container is a modification of the drop-bottom container. It has a rotary-type discharge valve designed to secure controlled flow and partial discharge of material when desired. The hopper bottom is equipped with a geared rotary valve of the controlled-flow type located at the apex of the slope sheets and having a single opening 18⅛ in. wide extending the full width of the container. The valve is automatically locked in the closed position and the lock must be manually released before the valve can be opened.

This type container is generally used for the transportation of lime and dolomite or similar materials used on the charging floor of open-hearth furnaces.

Hard-Glass Reflector Spot Light

General Electric has announced the development of a 300-watt R-40 reflector spot lamp. It has a heat-resistant glass bulb and mogul screw base, and is a companion to a previously announced flood lamp of the same wattage and size. The spot distribution of light had been made possible in a hard-glass reflector lamp by the development of a practical method for lightly frosting the inside of the face of the bulb. Heavy frosting results in a flood pattern, and no frosting at all causes striations to appear in the beam. Heat-resistant glass is considerably more difficult to frost than glass ordinarily used in lamp making.

Intended for outdoor use, the new spot lamp is designed to fill a need for a lamp to provide a small spot of light brighter and for longer distances than can be obtained with the flood lamp. They are recommended for use in industrial plants and yards, roadside stands, street railway yards, bus garages, airport hangars and aprons, and docks.

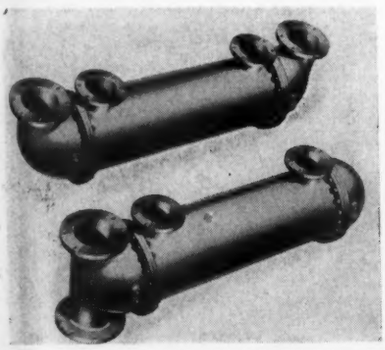
Th heat-resistant glass bulbs of these lamps withstand the thermal shock of drops of water, oil and grease much more effectively than do similar lamps without the special glass. The mogul screw base provides greater strength than does the medium screw base, and reduces temperature in the base, socket, and adjacent wire. Both the 300-watt spot and flood lamps are now available, and carry list prices of $3.60 to $3.00, respectively.

Removable Tube Bundle Heat Exchanger

Expanding its redesigned line of heat exchangers available from stock, the Young Radiator Co., Racine, Wis., has introduced its removable tube bundle, Type R, shell and tube heat exchangers.

The heat exhangers are of corrosion-resistant metal tubing. Tube sizes, including ⅜ in. outside diameter and ⅝ in. outside diameter, plus correct tube spacing and baffling, provide longer unit life, easier maintenance, and maximum heat transfer efficiency. The line consists of both single and two-pass models in a wide range of capacities up to 75 lb. per sq. in. pressure and temperatures up to 300 deg. F.

The units have been designed for a variety of heat transfer applications, including: engine jacket water and lubricating oil; oil cooling of bearings, machine tools, reduction gears, pumping units, turbines, cutting oil, quenching oil, transformers, hydraulic equipment, generator sets and miscellaneous fluid cooling such as fresh water, salt water, torque-converter fluid for power cranes, railroad cars and similar applications.



Machine Tool Conduit

The Chicago Metal Hose Corporation, Maywood, Ill., has added a Geon-covered flexible metal machine tool conduit to its line.

This conduit may be used for electrical shielding purposes and is particularly suited for use on machine tools because of its resistance to moisture, coolants, greases and oils. The abrasion-resistant cover is applied over a highly flexible galvanized steel convoluted steel tubing. This steel core and Geon cover provides a conduit to withstand abuse of installation and the wear of usage.

It is extremely flexible, and the maker states it will not bind or restrict movement when used between moving parts on machine tools. Liquid-tight steel fittings are usable with both standard and water-tight conduit boxes. They are attachable and re-attachable by the user or may be permanently attached by the manufacturer. Conduit is manufactured in sizes from ⅜-in. i.d. to 2-in. i.d. and can be furnished in mill lengths or cut lengths.

Plain and Universal Milling Machines

A milling machine, built in plain and universal styles, and powered by a 7½ hp. motor, has recently been announced by the Cincinnati Milling Machine Company, Cincinnati 9, Ohio. The No. 3MI unit has wide speed and feed ratios—60 to 1 and 120 to 1, respectively.

Sixteen spindle speeds, ranging from 25 to 1,500 r.p.m. are changed with a single crank type control. The crank operates a hydraulic selector valve, while the actual work of shifting gears is performed hydraulically. While the spindle is rotating, a safety interlock prevents the speed change crank from being moved.

Feed rates are changed in the same manner as speeds—one-half turn of a single crank type control, throughout the complete range of sixteen feeds, from ¼ to 30 in. per min. The crank and indicating dial are located at the front of the knee, readily available for instantaneous changes of feed rates. All operating controls are duplicated at the rear working position, left-hand side of the column.

The main drive clutch is a single-disc dry-plate unit, with accessible adjustment. A multiple disc spring-loaded brake, operated by the disengaging action of the starting lever, stops the spindle instantly when the drive clutch is disengaged.

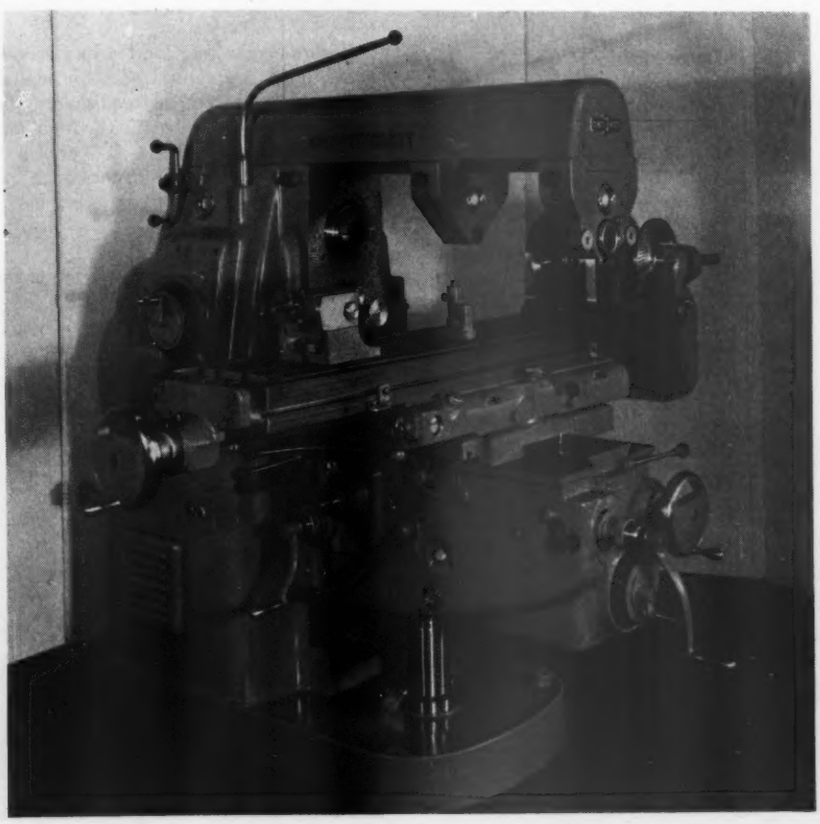
Parts within the column and knee of the miller are automatically lubricated from individual pump and cascade systems, with tubing carrying oil to out-of-the-way bearings. The pump in the column also supplies oil under pressure to the hydraulic gear shift mechanism.

Table ways and parts within the saddle and housing are lubricated by a manual pressure or oil-shot system built into the saddle. Arbor support bearings are automatically lubricated by a gravity system, from self-contained dust-tight reservoirs.

Cross and vertical hand cranks are automatically disengaged when their respective power feed levers are engaged. This arrangement constitutes an important safety feature for the operator.

Rapid traverse, at the rate of 150 in. per min. longitudinal and cross, and 75 in. per min. vertical, may be engaged through a lever control at the side of the knee. The starting lever may be adjusted to any position desired by the operator. This is accomplished through a conventional straight tooth clutch, cut into the end of the starting lever, engaging a similar clutch on the vertical starting shaft extending out of the column.

Elecrical controls are built-in for protection against dust, coolant, and dam-



age to 110 at the push button station. Another safety feature will be found in the contact button at the rear of the column, in the door closing surface. Start-stop push buttons are built into the column, on the left-hand side. Coolant equipment is included with the machine. It features a built-in centrifugal pump and a gravity return system.

The main drive clutch, brake, and all spindle drive gearing up to the back gear shaft is contained in a unit bolted to the rear wall of the column. Likewise, feed drive gears are contained in a unit bolted to the underside of the knee.

The apron on the knee, extending above its top surface, adds to the length of bearing surface on the column, and thereby increases rigidity. A wiper recessed into the top edge of this apron keeps the face of the column clean; prevents scoring.

All rotating shafts are completely covered to protect the operator. In addition, the cross screw is also covered for protection against the wearing effects of dust and chips.

Corrosion Resistant Flexible Hose

This hose, able to withstand high temperatures and pressures, is used for conveying corrosive or searching liquids and gases where motion is required.

Extreme flexibility gives hose the ability to withstand extreme cycles of vibration, flexation and variplane motions. For constant flexing or continuing motion a hose with closed corrugation pitch is recommended; for infrequent flexing, misalignment or slight movement an open corrugation pitch hose is recommended. Flexible hose that meets these requirements is now available from the Chicago Metal Hose Corp., Maywood, Ill.

This stainless steel hose is fabricated in sizes from 5/16 through 6 in. inside diameter in one or multiple ply construction. It is available with helical or annular corrugations, with or without braid covering, depending upon pressure and other factors of service use in wall thicknesses from 0.003 in. in single ply to 0.030 in. in multiple ply construction; working pressures to 2,000 lb. per sq. in. Standard pipe fittings or fittings to special requirement may be attached by silver brazing or welding.

Portable Pipe Threader

Illustrated below is the Porta-Drive unit manufactured by Muncie Gear Works, Inc., Muncie, Ind., which can be used to thread pipe in any position—horizontal, vertical, in close quarters, in corners or walls.

The threader is of interest to maintenance men and is designed to fit the aver-

age tool box. It weighs only 14 lb. One man operating the unit can thread up to 6-in. pipe.

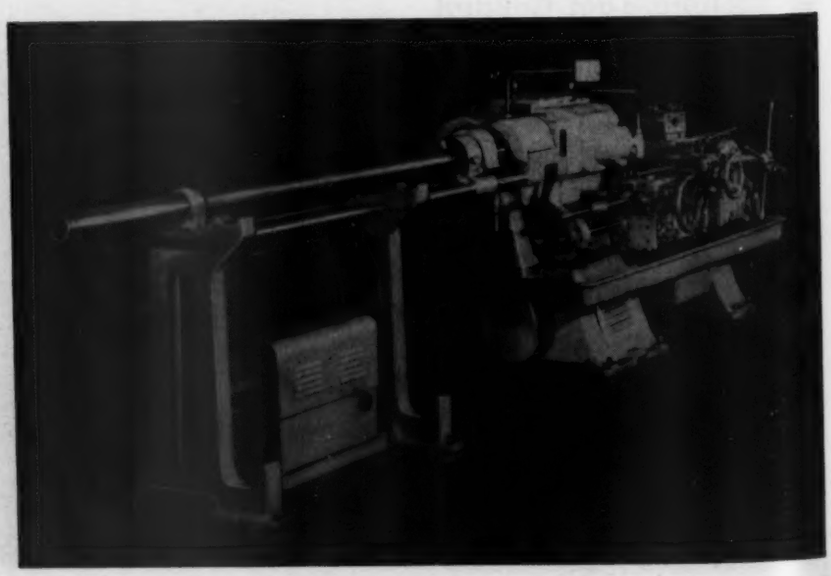
Actually a 20 to 1 gear-reduction unit, the Porta-Drive is driven by any ½ hp. heavy-duty electric drill and attaches to any standard set of dies through adaptor-yokes. An aluminum casing houses a bull gear and cold-rolled spur gears which are sealed in grease.

Bar Feed and Chuck Turret Lathe Accessory

A hydraulically controlled bar feed and collet chuck mechanism for J & L universal turret lathes has been introduced by the Jones & Lamson Machine Co., Springfield, Vt.

This device is illustrated in conjunction with the lathe. The mechanism was developed to meet a specific need in reducing operator fatigue caused by high speed continuous turning with carbide tools.

With a single lever located in a control panel, finger tip control of the complete operating cycle is accomplished. The lathe accessory can be installed on any Jones & Lamson No. 3, 4, 5, 7 or 8 universal turret lathe at the factory or in the field.



Miner Develops New Truck Spring Snubber

A new Class C-4-S truck spring snubber, recently developed by W. H. Miner, Inc., Chicago, was approved after more than 50,000 miles of road testing during 1949, these tests being supplemented by extensive laboratory research. All of the snubber tests were made under actual travel conditions in a conventional box car loaded in an approved manner, and Miner Impactographs were placed at each end of the car to record the complete characteristics of the rides.

This entirely new shock absorber has a unique control over vertical and lateral car oscillations, designed to ensure a flowing and shock-proof ride. Large frictional surfaces of the shoes are provided

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to give low unit bearing pressures essential to minimizing wear. The cylinder is made of special heat-treated steel to the same specifications as conventional Miner friction draft gears, and the three friction shoes are case-hardened steel, making them wear resistant to provide efficient snubbing for an extended period of service life.

In addition to the foregoing research, the C-4-S snubber was tested by the Association of American Railroads in October 1949.

This device has a travel of 1⅝ in. and measures 8¼ in. in height. It is interchangeable with A.A.R. springs, Classes C, D, H, C-2, D-2 and H-2, and can, therefore, be installed in new or existing equipment, requiring no special truck side frames. The snubber is held in its assembled position by an ingenious locking engagement between the shoes and the cylinder.

The C-4-S Snubber supersedes previous Miner designs, but component parts of the latter are available for reclamation programs.

Motor Starter

The Motor Sentinel, a manual motor starter with positive bimetallic overload protection, is available from the Westinghouse Electric Corporation. Especially suited to controlling and protecting small motors used with fans, pumps, small machine tools, grinders, stokers, etc., the starter fits any standard 2½-in. wall box. With a front-removable heater of the proper rating, the starter permits time delay for starting and allows motors to carry overloads up to their safe capacity without disconnecting them from the line. It will, however, automatically disconnect the motor on any sustained or damaging overload.

For surface mounting, the Motor Sentinel is available in an alloy enclosure with Bonderized baked enamel finish. Special cast iron enclosures are provided for watertight and explosion-proof applications.

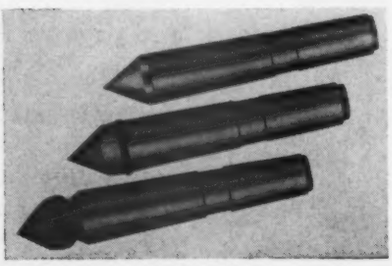
Positive operation is provided by means of the overcenter toggle mechanism. Double break silver contacts and copper alloy or plated steel parts are used to assure long, trouble-free life. Straight-through wiring avoids complicated turns and bends. For convenience and accessibility, all terminals are at the front, with line terminals at the top, and load terminals at the bottom.

Wear Resistant Tips For Lathe Centers

A replaceable tip for lathe and grinder centers has been made available by Diamonds and Tools, Inc., Div. of Wall Colmonoy Corp., 19345 John R. st., Detroit 3, Mich. With the advent of Colmonoy wear resistant tips, it is not necessary to scrap centers when they are worn back too far for further grinding.

As shown in the illustration, the tip or cap can easily be silver-soldered to the wear end of the scrap center facilitating indefinite use for years merely by retipping when necessary.

It is claimed that these tips last at least seven times longer in between grinding than high-speed steel. Further, the total cost for reclaiming worn out centers is less than buying a new high-speed steel one. They are now available in their cast form or already applied to standard size centers and finished ground.

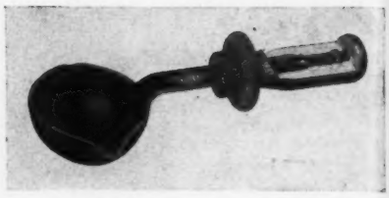


Short-Handled Melting Ladle

Illustrated is a handy device, recently introduced by the Unique Mfg. Co., Inc., 226 W. Walton st., Chicago 10. It is melting ladle with an air-cooled wooden handle which can't char or pull off. A close-to-bowl grip that eliminates arm strain and permits accurate, comfortable control of the molten metal is a feature.

The handle is cut away in the illustration, showing the air space around the shank inside, which keeps the handle cool at all times. The handle is easily replaceable, requiring only a screwdriver to attach or remove.

The lips of the bowl are slightly lower than the rest of the edge, and the point of the lip does not form the usual angle, but is circular and points downward. This



feature enables the user to pour solder drop by drop or in a steady stream without spilling over the edge of the bowl.

Air-Operated Drop Stamp

Illustrated below is the Model L drop stamp which uses impact blows of controlled intensities to produce a wide variety of metal shapes from any of the formable metals.

Control mechanisms of the Cecostamp unit produced by the Chambersburg

Engineering Co., Chambersburg, Pa., are located in such a position that the operator is free of moving parts. Frame-to-anvil bolts and springs are recessed avoiding hazards to clothing. Self-positioning safety rests, built into the side frames between the guides, hold the ram when changing dies or working between dies. A steel bolster plate on the anvil equipped with T slots makes for rapid and accurate setting of dies.

The unit has been adapted to the manufacture of bus and automobile bodies, sheet metal aircraft parts, rail cars, and numerous other products. The Cecostamp meets the demand for greater capacity that has resulted in use of these tools in forming, shaping, drawing and stamping metallic sheets.

This centralization of responsibility for all phases of performance is another reason why General Motors locomotives are first choice in the rapidly growing Diesel fleets of America's leading railroads.

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

General Motors, La Grange, Illinois

Home of the Diesel Locomotive

NEWS

A.S.M.E. Railroad Division To Meet in St. Louis

IN conjunction with the semiannual meeting of the American Society of Mechanical Engineers at the Hotel Statler, St. Louis, Mo., June 19-23, the Railroad Division will hold two technical sessions on June 20.

Subjects for the morning session will be "Treating Feedwater for Railway Diesel Steam Generators," by John F. Wilkes, technical director, railroad department, Dearborn Chemical Company, Chicago; and "Dynamics of 'Shimmy' in Passenger Car Trucks," by S. G. Guins, project engineer, office of research consultant, Chesapeake & Ohio, Cleveland, Ohio.

In the afternoon, subjects will include "Development and Testing of Brakes for High-Speed Railroad Equipment," by Carl E. Tack, assistant chief mechanical engineer, American Steel Foundries, Chicago; and "High-Speed Braking," by C. L. Eksergian, executive engineer and assistant to vice-president, Budd Company, Philadelphia, Pa.

Coordinated Mechanical Association Meetings

THE Coordinated Mechanical Associations, comprising six associations of railway mechanical department supervisors, will hold their next annual meeting at the Hotel Sherman, Chicago, September 18 to 20, 1950. Owing to lack of accomodations for all six associations simultaneously at the Sherman, meetings of one of them, the Car Department Officers' Association, will be held this year at the Hotel LaSalle, but the members will participate in all joint functions at the Sherman. An exhibition of railway equipment and supplies, electrical in character, will be sponsored by the Railway Electric Supply Manufacturers' Association.

Equitable Life to Buy And Lease Freight Cars

A PLAN to purchase new freight cars from manufacturers and lease them to domestic railroads has been developed by the Equitable Life Assurance Society, Thomas I. Parkinson, president, has announced. The plan, which is supported by the Pullman-Standard Car Manufacturing Company, is designed to enable railroads to secure immediately, without down payment, as much new freight equipment as they need.

In traditional practice, railroads have been required to make a minimum 20 per cent cash down payment on purchases of new freight cars.

Over 30 per cent of freight cars now in use are more than 25 years old and substantially over one-half are more than 20 years old, Mr. Parkinson said. By the end of the twentieth year of service most railroads find it necessary to rebuild their freight cars. Yet, after such rebuilding, the cars still have such 20-year-old disadvantages as limitation of size and excess weight. Many engineers contend it would be more economical for railroads to scrap 20-year-old cars than rebuild them. However, to get the car fleet even close to the ideal, where

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

Item No.		Month of December		12 months ended with December	
		1949	1948	1949	1948
	FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)				
	Road locomotive miles (000) (M-211):				
3-05	Total, steam	29,704	41,202	390,869	542,014
3-06	Total, Diesel-electric	15,066	10,763	152,962	105,643
3-07	Total, electric	791	913	9,524	11,633
3-04	Total, locomotive-miles	45,561	52,878	553,379	659,294
3	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,435	1,604	17,854	20,642
4-06	Empty, total	869	936	10,154	10,802
4	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6					
6-01	Total in coal-burning steam locomotive trains	45,552	63,330	611,875	858,275
6-02	Total in oil-burning steam locomotive trains	11,831	17,897	175,425	248,913
6-03	Total in Diesel-electric locomotive trains	42,031	30,754	435,635	307,013
6-04	Total in electric locomotive trains	2,097	2,302	25,539	29,134
6-06	Total in all trains	101,517	114,289	1,248,609	1,443,417
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.05	1.06	1.05	1.07
10-02	Loaded freight car-miles	35.30	34.30	36.20	35.80
10-03	Empty freight car-miles	21.30	20.10	20.60	18.70
10-04	Total freight car-miles (excluding caboose)	56.60	54.40	56.80	54.50
10-05	Gross ton-miles (excluding locomotive and tender)	2,494	2,447	2,534	2,500
10-06	Net ton-miles	1,110	1,125	1,138	1,176
12	Net ton-miles per loaded car-mile (M-211)	31.50	32.80	31.40	32.90
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	62.30	63.10	63.70	65.60
14	Averages per train hour (M-211):				
14-01	Train miles	17.10	16.60	16.90	16.20
14-02	Gross ton-miles (excluding locomotive and tender)	41,994	40,013	42,343	39,903
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	41.20	43.90	41.80	46.10
14-02	All	38.30	42.00	39.30	44.10
15	Average net ton-miles per freight car-day (M-240)	752	870	788	952
17	Per cent of home cars of total freight cars on the line (M-240)	50.10	45.00	50.00	38.50
	PASSENGER SERVICE (DATA FROM I.C.C. M-213)				
3	Road motive-power miles (000):				
3-05	Steam	14,757	19,841	184,580	234,604
3-06	Diesel-electric	14,032	11,895	153,232	128,379
3-07	Electric	1,751	1,883	19,862	21,497
3-04	Total	30,539	33,640	357,788	384,575
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	294,497	318,222	3,366,728	3,586,548
4-09	Total in coal-burning steam locomotive trains	79,263	112,333	967,939	1,290,541
4-10	Total in oil-burning steam locomotive trains	42,101	52,808	521,720	643,604
4-11	Total in Diesel-electric locomotive trains	153,888	132,566	1,659,387	1,418,276
12	Total car-miles per train-miles	9.47	9.35	9.22	9.17
	YARD SERVICE (DATA FROM I.C.C. M-215)				
1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	1,511	2,355	20,546	30,879
1-02	Steam, oil-burning	244	357	3,265	4,639
1-03	Diesel-electric[1]	2,280	1,869	24,064	20,039
1-06	Total	4,063	4,611	48,190	55,914
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	83	131	1,066	1,485
2-02	Steam, oil-burning	14	21	183	241
2-03	Diesel-electric[1]	240	207	2,536	2,248
2-06	Total	374	397	4,206	4,398
3	Hours per yard locomotive-day:				
3-01	Steam	7.60	9.80	8.00	10.40
3-02	Diesel-electric	17.50	18.40	17.20	18.30
3-05	Serviceable	13.80	13.80	13.30	14.10
3-06	All locomotives (serviceable, unserviceable and stored)	11.30	12.20	11.10	12.40
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles)	1.95	1.98	1.87	1.88
5	Yard and train-switching locomotive-miles per 100 passenger train car-mles (with locomotives)	0.79	0.77	0.78	0.76

[1] Excludes B and trailing A units.

RAILROADS PREFER TEXACO

More railroad Diesel locomotives in the U. S. are lubricated with TEXACO than with any other brand.

Texaco Diesel lubricants and service are available in all 48 States.

Photo courtesy New York, New Haven and Hartford R.R.

GET MORE MILEAGE BETWEEN OVERHAULS

Lubricate with TEXACO DIESELTEX HD

CLEANER OPERATION — that's assured when you lubricate your Diesel locomotives with *Texaco Dieseltex HD.* You'll prove it at overhaul time when you see the clean condition of top decks . . . note the absence of harmful carbon, gum and varnish . . . the reduction in wear.

These benefits spring from *Texaco Dieseltex HD's* exclusive formula. The fully detergent and dispersive properties of this outstanding oil are strengthened by a special heavy-duty additive that increases resistance to oxidation and sludge formation.

On the road as in the laboratory, *Texaco Dieseltex HD* has proved it keeps engines cleaner under the severest operating conditions. Count on it to assure improved performance, greater mileage between overhauls, lower maintenance costs. *Texaco Dieseltex HD* meets the stringent requirements of leading Diesel locomotive builders.

Texaco railroad Diesel lubricants and unique systematic engineering service are available in all 48 States. Call the nearest Railway Sales Office listed below for a Texaco representative and full information. Or write The Texas Company, *Railway Sales Department,* 135 East 42nd St., New York 17, N. Y.

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TEXACO

TEXACO Dieseltex HD

FOR ALL RAILROAD DIESELS

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no cars would be over 20 years old, would take far more money than railroads ever will have available—probably between $5 billion and $5½ billion. By comparison with these requirements, freight car purchases in 1948 reached a 20-year high of only $417,000,000.

The Equitable plan is based on two documents: A purchase agreement between Equitable and the car manufacturer, and a lease of the cars between Equitable and the railroad. Under the purchase agreement with the manufacturer, Equitable makes a down payment in cash and agrees to pay the balance in equal instalments over five years, so long as rentals are received for the cars from the railroad. Interest is paid during the five years on unpaid balances owed the manufacturer.

According to terms of the agreement with a railroad, Equitable leases the cars to the railroad for an initial term of 15 years, daily rental to vary with the type and cost of a car. The railroad is given an option of returning the cars to Equitable at the end of such term or of continuing to lease any or all of them for an additional term of up to 10 years at 20 cents a day. For the term of the lease all repairs will be paid for by the railroad.

The attitude of the Pullman interests toward the plan is indicated by the following excerpt from a statement regarding it in the annual report of Pullman, Inc.: "The corporation intends to participate in the financing of new equipment built under this leasing plan, and if the plan develops as anticipated, substantial sums will be employed for this purpose."

Duff Smith Dies

T. DUFF SMITH, secretary-treasurer of the Railway Fuel & Traveling Engineers' Association, died in Chicago on March 18, after an illness of several weeks. Mr. Smith was born in Essex, England, on October 2, 1868. He was educated in British public schools and went to Canada in February, 1906, entering railway service as fuel clerk on the Canadian Pacific at Winnipeg, Man. He served as chief fuel clerk, C.P., at Winnipeg from November, 1908, to May, 1911; as fuel agent, Grand Trunk Pacific (now part of the Canadian National) at Winnipeg, from May, 1911, to April, 1922; and as lake forwarding agent, C.N., at Cleveland, Ohio, from April, 1922, to December, 1931, retiring from railroad service on January 1 of that year. Mr. Smith was active in the organization of the International Railway Fuel Association, which he served in various capacities. He was president of the association in 1912 and member of the executive committee from 1910 to 1936. He had served the International Railway Fuel Association and its successor, the R.F. & T.E.A., as secretary continuously since May, 1932.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE APRIL ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	No. of units	Horsepower	Service	Builder
Erie	8[1]	1,500	Freight	Alco-G.E.
	14	1,500	Road switch	Alco-G.E.
	26	1,500	Road switch	Electro-Motive
	5	1,000	Yard switch	Electro-Motive
	9	1,500	Road switch	Baldwin Loco.
	6	1,000	Yard switch	Lima-Hamilton
Southern Pacific	88[2]	1,500	Freight	Electro-Motive
	8[2]	1,500	Passenger	Alco-G.E.
	12	1,500	Freight	Baldwin Loco.
Toronto, Hamilton & Buffalo	4	1,200	Switch	Gen. Motors-Canada
	4	1,500	Road switch	Gen. Motors-Canada

LOCOMOTIVE INQUIRIES

Chesapeake & Ohio	5[3]	1,200	Switch	
	16[3]	1,500	Road	

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Lehigh Valley	500	Box	Pullman-Standard
Louisville & Nashville	500[4]	50-ton box	Pullman-Standard
Minneapolis, St. Paul & Sault Ste. Marie	75[5]	70-ton covered hopper	American Car & Fdry.
Missouri Pacific	500[6]	50-ton box	Company Shops
	510[6]	70-ton hopper	Company Shops
Reading	1,000[7]	50-ton hopper	Bethlehem Steel
	500[7]	50-ton box	American Car & Fdry.
Spokane International	23[8]	70-ton covered hopper	American Car & Fdry.

FREIGHT-CAR LEASES

Atlantic Coast Line	700[9]	50-ton pulpwood	Pullman-Standard
	600[9]	70-ton covered hopper	Pullman-Standard

PASSENGER-CAR INQUIRIES

Road	No. of cars	Type of car
New York, Susquehanna & Western	16	Coaches

[1] To be used as two four-unit locomotives.
[2] Deliveries scheduled to start in July and to be completed by the end of the year. The 88 units will make 22 four-unit locomotives; the eight units, two four-unit locomotives.
[3] To be used to Dieselize completely the Canadian division of the Pere Marquette.
[4] To cost $2,500,000. To be delivered by July 1.
[5] In the April issue it was incorrectly stated that these cars were to be built in company shops.
[6] In addition to the cars ordered for the Missouri-Illinois as reported in the April issue. 250 of the 50-ton box cars are for the Gulf Coast Lines.
[7] The 1,000 hoppers will cost approximately $4,400,000; the 500 box cars, approximately $2,500,000.
[8] Estimated cost, $170,000.
[9] To be financed by the Equitable Life Assurance Company under the plan described on page 296. of this issue. Production of the cars is scheduled to begin this summer at the rate of 25 a day.

NOTES:

Bessemer & Lake Erie.—The Greenville Steel Car Company has received an order to repair 300 of the Bessemer & Lake Erie's triple hopper cars. New bodies will be required for almost all the cars. The work began late in April and is expected to proceed at a daily rate of 10 to 15 cars.

Canadian National.—New equipment to be bought by the Canadian National this year will include 67 Diesel-electric locomotives, 57 baggage cars and 50 sleeping cars, according to budget figures submitted recently to the House of Commons at Ottawa, Ont. The total cost of new equipment to be purchased by the road was estimated at $36,698,430.

Chesapeake & Ohio.—"Development work on the new lightweight Train X (has) reached the stage where it is now being carried on jointly with Pullman-Standard Car Manufacturing Company," according to the annual report of the C. & O. for 1949.

Chicago & Western Indiana.—Two years after arrival of the first Diesel locomotives on its property, operations of the Chicago & Western Indiana have become 100 per cent Dieselized. Recent receipt of the last of 12 switchers ordered from the American Locomotive Company has enabled retirement of all steam power from operating work. Present plans calls for retention of two of the more modern steam locomotives as an emergency source of steam for the company's coach yard. However, it is not intended that they be used further as a source of motive power for train movements. Two 1,000-hp. switching units built by Electro-Motive Division of General Motors, and 12 1,000-h.p. switchers built by Alco-General Electric replace 27 steam locomotives formerly required for regular operations. Except for the two E.-M. units, all the Diesels have steam generators, permitting flexible assignment of power between switching and suburban service.

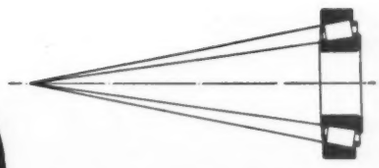
Chicago, Rock Island & Pacific.—The board of directors of the Rock Island has authorized the purchase of 20 Diesel-electric locomotive units at an estimated total cost of $2,500,000. As a further step toward its goal of complete Dieselization, the road plans to acquire 12 1,500-hp. road switching units, 7 800-hp. switching units and 1 2,250-hp. passenger unit.

New York Central.—The New York Central is negotiating with the Equitable Life Assurance Society for financing the acquisition of the 1,500 50-ton box cars recently ordered from Pullman-Standard as noted on page 233 of the April issue.

Norfolk & Western.—The N. & W. has received 30 steam switching locomotives of the 0-8-0 type from the Chesapeake & Ohio at an approximate cost of $50,000 each. The locomotives were ordered by the C. & O. in December, 1947, and built by the Baldwin Locomotive Works in 1948.

Texas & Pacific.—The Texas & Pacific board of directors has authorized purchase of 23 Diesel-electric locomotive units at an approximate cost of $3,500,000. Included in the authorization were two 4,500-hp., six 3,000-hp. and one 1,500-hp. road locomotives and four 1,000-hp. switchers. All the equipment, except two of the switchers (which are for hump operations in Lancaster yard), will be used to Dieselize completely all freight service between Big Spring, Tex., and El Paso.

No other bearing with so much to offer!



1 Rolls can't slide laterally —due to the tapered design of a Timken® tapered roller bearing. Roll ends are held firmly against the cone rib at all times.

2 Rolls stay put...for life! The rolls in a Timken tapered roller bearing are permanently retained in the bearing assembly. Can't fall out and pick up dirt during bearing changes.

3 Hard on the outside—tough on the inside! Rolls and races made of Timken fine alloy steel with wear-resisting surface and tough, shock-resistant core.

4 No special thrust blocks needed. Timken bearings take *both* radial and thrust loads!

5 Use either oil or grease!

6 No roll skidding or skewing! Cone rib keeps tapered rolls in positive alignment. Load is spread over full roll length.

7 No adjustments needed when wheel and axle assembly are installed in the truck.

8 Axle magnaflux inspection simplified! Bearings press off with the wheel.

9 Rolls uniformly sized for their particular cone. Each roll carries its full share of the load.

10 Polished axle ends aren't necessary! No thrust block used.

11 Special axle length tolerances not required.

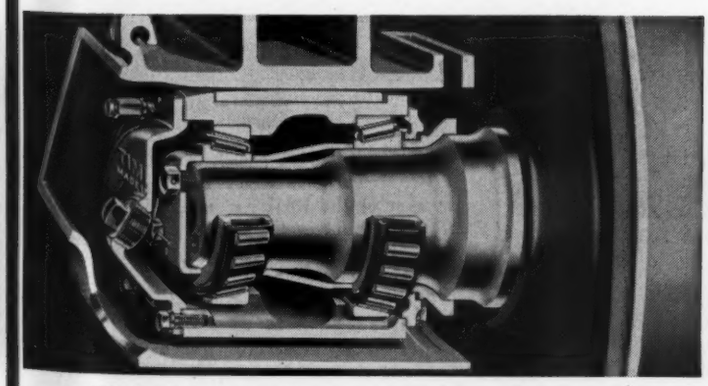
USED ON OVER 5,000 PASSENGER CARS, OVER 6,000 STEAM, DIESEL AND ELECTRIC LOCOMOTIVES, 3,900 FREIGHT CARS!

Pioneer of anti-friction bearings for railroads, Timken has remained the leader ever since.

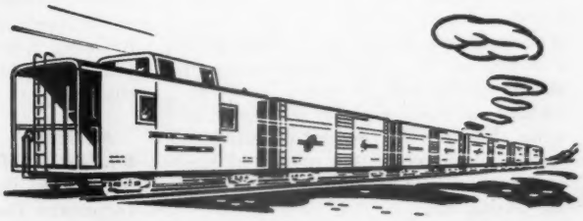
The advantages of Timken bearings have been conclusively proved in every type of railroad operation. Today, more steam locomotives, passenger cars and freight cars roll on Timken bearings than any other make of anti-friction bearings.

Let us help you with your bearing applications. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

No other bearing so fully proved!



Timken bearing application for freight car changeovers.



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NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION →✳←

SUPPLY TRADE NOTES

Pressed Steel Testing Two Wholly New Car Types

The Pressed Steel Car Company, in conjunction with another group in the engineering and design field, "is well on the way toward completing and testing two wholly new types of freight cars," according to the former's annual report for 1949. The cars have not yet been exhibited, John I. Snyder, Jr., Pressed Steel Car president, said in the report. "All of our preliminary tests so far have shown encouraging results." he added. "In general, we believe that these cars, in comparison with conventional cars, will (1) be stronger, (2) be lighter by several tons, (3) have greater cubic capacity while retaining standard clearances, (4) be cheaper to maintain, (5) be operated with less lading damage, (6) be substantially less costly to load and unload, (7) be more impervious to weather, (8) be cleaner and easier to clean, (9) be attractive to look at from the public's point of view, and (10) be cheaper, in production, to buy or rent."

General American-Evans Company to Lease Box Cars

The General American-Evans Company, Chicago, jointly owned subsidiary of the General American Transportation Corporation (90 per cent) and Evans Products Company (10 per cent) has been organized to lease to railroads or private car owners, or both, an improved box car designed to eliminate damage to lading in shipments as well as the need for dunnage required in ordinary methods of blocking and securing loads for safe movement by rail.

The cars will be equipped with Duryea underframe, the Evans DF-Loading device and trucks of Chrysler design built by the Symington-Gould Corporation. Floors will be made of steel and the sides strengthened. The reinforced floors, in conjunction with 8 ft. wide side doors, will make possible more effective use of power lift trucks in loading and unloading goods.

It is anticipated the new car will cost about $9,000, compared with $5,000 to $6,000 for a conventional box car. To encourage use of the new cars, General American-Evans proposes to lease them to the railroads at a rental of about $125 a month, or $4 a day. Improvement in railway service and reduction in operating cost and damage claims as a result of using this type of car are expected to justify a charge for the use of off-line cars on a mileage basis sufficient to cover the leasing cost.

PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—The Pullman-Standard Car Manufacturing Company has arranged to build the first freight cars the Equitable Life Assurance Society will lease to a railroad under the latter's new financing plan described on page 296 of this issue. The initial order is for 700 50-ton pulpwood and 600 70-ton covered hopper cars, costing about $7,500,000, which will be leased to the Atlantic Coast Line.

James E. Candlin, Jr., associate director of the Mechanical division, Pullman-Standard has been appointed also deputy director of research. *Ralph Haman*, acting associate director of the Styling and Architectural division, has been made consultant for design and styling to the director of research, and has been succeeded by *Fred Girardy*.

◆

EATON MANUFACTURING COMPANY.—*Eugene W. Caruthers*, who recently retired as assistant engineer in the office of the chief engineer of the Pennsylvania, has been appointed special engineer to the Reliance division of the Eaton Manufacturing Company, Massillon, Ohio, with headquarters at Philadelphia, Pa.

Mr. Caruthers had served as assistant engineer on the P.R.R. for 43 years. Before joining that railroad he had seen service with the New York Central, the Norfolk & Western and the Baldwin Locomotive Works. He has been a member of the Track committee of the American Railway Engineering Association for many years, and recently retired as its chairman.

Eugene W. Caruthers

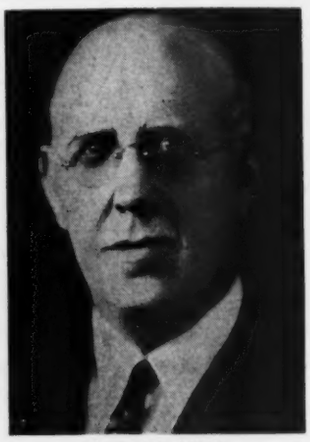
◆

AMERICAN LOCOMOTIVE COMPANY.—*William G. Miller*, formerly manager of the Auburn, N. Y., plant of the American Locomotive Company, has been appointed executive assistant to the chairman and president, Duncan W. Fraser. He is succeeded at Auburn by *Charles T. Lathrop*, formerly works manager there.

Mr. Miller joined the Alco products division of the company at New York in 1932 as a project engineer and, in 1937, was sent to France to direct construction of oil-refining units for a French affiliate of the Anglo-Iranian Oil Company. He returned to New York in 1939 and one year later was transferred to the staff of the vice-president in charge of manufacturing. In October, 1945, he became superintendent of the Diesel locomotive division in Schenectady, N. Y., and, in February, 1948, assistant to the manager of the Auburn plant. He became manager six months later.

◆

OKONITE COMPANY.—*A. L. McNeill*, vice-president of the Okonite Company, has been placed in charge of a newly created national railroad sales department, with the title of vice-president, national railroad sales.



A. L. McNeill

HARNISCHFEGER CORPORATION.—*Melvin O. Monsler* has been appointed sales manager of the P&H welding division of the Harnischfeger Corporation.

A. G. Hendrickson has been appointed assistant sales manager of the P&H welding division, Harnischfeger Corporation, Milwaukee, Wis. Mr. Hendrickson has served as welding engineer in the Milwaukee and Minneapolis, Minn., territories for the past five years.

Mr. Monsler has been associated with the latter division for 12 years, having served as a welder, assistant to superintendent, welding product service engineer and assistant sales manager. Prior to joining P&H he was an instructor in welding and shop procedure, Milwaukee School of Engineering.

Today it's Roebling!

Roebling V. C. Cable is the first choice for diesel locomotives

ELECTRICAL CABLES for diesel locomotives must be able to withstand high temperatures . . . degrees of heat that would soon cause failure in ordinary cables. Roebling points with pride to the fact that Roebling Varnished Cambric Cable meets this requirement with complete dependability. In addition, it is built with a high safety factor that takes most overloads. On the basis of proven performance Roebling V.C. is today's A-1 specification with manufacturers of diesel locomotives!

And there is similar efficiency and long-run economy in Roebling's other electrical wires and cables that serve in the transportation field . . . Signal Cable and Cab Cable with ROEPRENE jackets . . . Jumper Cables and Control Cables . . . Hard drawn bare copper wire, with or without weather-resistant covering . . . Trolley wire and a complete line of Magnet Wire.

Write for full information about any or all of these quality wires and cables.

ROEBLING

A CENTURY OF CONFIDENCE

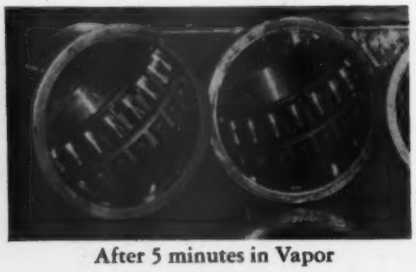
Atlanta, 934 Avon Ave. ★ *Boston*, 51 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Road ★ *Cincinnati*, 3253 Fredonia Ave. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 4801 Jackson St. ★ *Houston*, 6216 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. Twelfth St. ★ *Portland*, 1032 N. W. 14th Ave. ★ *San Francisco*, 1740 Seventeenth St. ★ *Seattle*, 900 First Avenue S.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON 2, NEW JERSEY

CLEAN PARTS FASTER
at lower cost

Model C-120 Vapor-Spray Degreaser, Height 128"; Length 127⅜"; Width 75⅜"; Cleaning Capacity 18,000 lbs. per hour.

Roller Bearing before Degreasing



After 5 minutes in Vapor

DESIGNED especially to handle railroad cleaning problems including those encountered in diesel service shops, this Circo vapor-spray degreaser eliminates costly hand labor operations. Circo installations throughout the country attest to the efficiency and speed of the vapor method for cleaning armatures, field frames, housings, axle caps, roller bearings and most other parts and assemblies. *Savings of over 90% in time alone are common.*

Not only is valuable time saved but better cleaning is assured. The warm vapor thoroughly penetrates every slot and crevice, absolutely removing all traces of dirt, oil and grease. Depending on size, parts can be removed, *absolutely clean and dry,* in 5 to 30 minutes.

This compact Circo degreasing unit uses a nonflammable solvent that is both safe and economical. Efficient operation is assured by a fully automatic control system. For long life this Circo model is available of nickel clad, stainless clad or zinc sprayed steel construction.

Take advantage of the savings available with proven Circo vapor-spray degreasing units. Obtain better parts cleaning, in 1/10 the time at a fraction of former costs. A Circo engineered degreaser will pay for itself many times over.

A-2994

CIRCO PRODUCTS COMPANY
Metal Cleaning Equipment
6531 EUCLID AVE. • CLEVELAND, OHIO

PIONEERS IN THE DEVELOPMENT OF HOT VAPOR CLEANING EQUIPMENT

JENNISON-WRIGHT CORPORATION.—*Edward J. Littleton* has been appointed manager of railroad sales of the Jennison-Wright Corporation.

Mr. Littleton began his business career with the Chicago, Milwaukee, St. Paul & Pacific in 1928 as buyer of forest products. He left the Milwaukee in 1940 to enter the wood preserving industry, serving railroads, utilities and industry. He joined Jennison-Wright in September, 1947.

◆

VAPOR CAR HEATING COMPANY.—The Vapor Car Heating Company of Canada, Montreal, Que. (affiliated with Vapor Heating Corporation, Chicago), has purchased a second plant in Montreal, containing 33,000 sq. ft. of factory space, almost doubling that of the present plant, which has 40,000 sq. ft. Also included in this purchase is an additional 75,000 sq. ft. of property for future expansion. The new plant will be used to manufacture Vapor steam generators for Canadian railroads.

◆

JOHN A. ROEBLING'S SONS COMPANY.—*Walter A. Huber* has been appointed general manager of the Wire Rope Division of the Roebling Company.

◆

KAISER ALUMINUM & CHEMICAL CORP.—The *Permanente Metals Corporation* has changed its corporate name to Kaiser Aluminum & Chemical Corp., in order to achieve a closer identification with its principal products—Kaiser aluminum and chemicals. Also, the corporation's wholly-owned sales subsidiary, *Permanente Products Company,* has been renamed *Kaiser Aluminum & Chemical Sales, Inc.*

◆

AMERICAN STEEL FOUNDRIES.—*A. J. McDonald,* vice-president of American Steel Foundries, has been awarded the Lorenz Memorial Gold Medal by the Steel Founders' Society of America. The medal is an award for outstanding service to the industry.

◆

BAKER-RAULANG COMPANY.—*W. H. Haas* and *J. B. Akers,* of the firm of Haas & Akers, Washington, D. C., have been appointed special railroad representatives of the Baker Industrial Truck division of the Baker-Raulang Company. In addition to handling sale of Baker equipment to railroads along the southeastern seaboard, the firm will act in a consulting capacity on application of Baker trucks.

◆

HYSTER COMPANY.—The *Northeast Industrial Equipment Company,* Cambridge, Mass., has been appointed by the Hyster Company, Portland, Ore., to handle sales and service of Hyster lift trucks, straddle trucks, mobile cranes and their attachments, in Maine, New Hampshire, Rhode Island and 10 counties of Massachusetts.

◆

CARNEGIE-ILLINOIS STEEL CORPORATION.—*Dwight L. Merrell,* formerly manager of sales for construction industries of the Carnegie-Illinois Steel Corporation, a United States Steel Corporation subsid-

to select tool steels

Get the right answer instantly

The CRUCIBLE TOOL STEEL SELECTOR uses the only *logical* method to select the *right tool steel right from the start!* Your own experience tells you that the *application* should dictate the choice of the tool steel...and Crucible has applied 50 years of tool steel leadership to adapt this idea to the simplest, handiest instrument you've ever used—the Crucible Tool Steel Selector. Put an end to costly trial and error tool steel selection. When you're tooling up, a turn of the Selector gives you the *right answer*—instantly.

Satisfactory in every case

Now you can start with the application, and the answer you get from the Selector will prove satisfactory in every case, for the Crucible Tool Steel Selector covers 22 Tool Steels which fit 98% of all Tool Steel applications. You no longer need to start with a steel of known characteristics and back your judgment with a costly trial experiment.

And here's an important production point! ALL the tool steels on the Crucible Tool Steel Selector are in warehouse stock . . . that means when you get the answer, you can get the steel . . . fast!

Send for your selector today

You'll want the CRUCIBLE TOOL STEEL SELECTOR . . . and we want you to have it! Remember—nothing you've seen before approaches your tool steel problems so simply and logically!

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Name_____ Title_____

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CRUCIBLE first name in special purpose steels

TOOL STEELS

fifty years of Fine steelmaking

Branch Offices and Warehouses: ATLANTA · BALTIMORE · BOSTON · BUFFALO · CHARLOTTE · CHICAGO · CINCINNATI · CLEVELAND · DENVER DETROIT · HOUSTON, TEXAS · INDIANAPOLIS · LOS ANGELES · MILWAUKEE · NEWARK · NEW HAVEN · NEW YORK · PHILADELPHIA · PITTSBURGH PROVIDENCE · ROCKFORD · SAN FRANCISCO · SEATTLE · SPRINGFIELD, MASS. · ST. LOUIS · SYRACUSE · TORONTO, ONT. · WASHINGTON, D. C.

Everywhere you hear "#1100 is a *Find* for windings!"

That's why hundreds of new users have switched to

Irvington #1100

clear, stable insulating varnish

One trial did it in the many shops now standardizing on Irvington #1100. Their endorsements boil down to: "We like its stability in dip tank and in storage . . . its clear color and low cost. We use this one varnish on practically all our windings, and cut inventories."

They like its oil and chemical resistance, too . . . the way this new insulating varnish sinks into remote coil layers and grips the wire, forming a solidly bonded mass. Internal-curing, it hardens throughout after a short bake, to a durable, oil-proof coating. The solvent is V. M. & P. naphtha, which does not attack other insulating materials.

Irvington #1100, backed by heavy research, excels on all windings except those operating at highest speeds. One varnish does all, and saves you real money, too. Write for a sample.

Specifications:

Dry Dielectric	2000 VPM
Moisture Resistance	Good
Oil Resistance	Excellent
Acid Resistance	Excellent
Alkali Resistance	Good
Heat Resistance	Very Good
Penetration	Excellent
Baume	25° @ 30 deg. C.
Sp. Gr.	0.903 @ 30 deg. C.
Sp. Gr. for use	Optional
Solvent	V. M. & P. Naphtha

Look to Irvington

for Continued Leadership in Insulation

IRVINGTON VARNISH & INSULATOR CO.
Irvington 11, New Jersey

iary, has been appointed sales manager of this subsidiary for the Philadelphia, Pa., district. Other managerial promotions are as follows: *Samuel McClements, Jr.*, has been appointed sales manager for the railroad materials and commercial forgings division; *F. Royal Gammon*, sales manager for the Eastern area; *Wesley C. Bobbitt*, sales manager in the New York district, and *Donald K. Wright*, assistant sales manager in Philadelphia.

◆

BARCO MANUFACTURING COMPANY.—F. N. Bard, president of the Barco Manufacturing Company, Chicago, has announced the acquisition of the *Valve Pilot Corporation* of New York. Valve Pilot manufactured for Diesel, steam and electric locomotives a number of specialties, such as speed recorders, which henceforth will be produced in Barco facilities in Chicago. The office and equipment of Valve Pilot will be removed entirely to Chicago.

◆

GOULD STORAGE BATTERY COMPANY.—*H. S. Carlsen*, assistant to the vice-president, Gould Storage Battery Corporation, has been assigned to the co-ordination of railroad sales activities. As co-ordinator of railroad sales activities, Mr. Carlsen will expedite the flow of battery information to railroad design and specification engineers, and will speed handling of inquiries and purchases from operating and purchasing executives.

Mr. Carlsen, a graduate of the University of Minnesota, has been acting

H. S. Carlsen

as northeast regional manager in eastern New York and New England. He joined the battery industry in 1933, and has worked on all phases of production, service and sales. His background includes experience as plant engineer, production manager, and sales managerial posts. He will be located in Trenton, N. J., where the sales headquarters of Gould are located.

◆

ELECTRO-MOTIVE DIVISION, GENERAL MOTORS CORPORATION. — The Electro-Motive Division, General Motors Corporation, has opened a new service office, known as the Washington Regional Service Office, in the Transportation building,

STRIPPING TWO CAR WHEELS SIMULTANEOUSLY AT N.Y.O. & W.R.R. SHOPS, MIDDLETOWN, N. Y.

All standard MCB car axles and wheels, together with trailer sets and diesel locomotive wheels, can be stripped in the Chambersburg Duplex Wheel Press with a speed unequalled by any other method.

STRIPPING DIESEL WHEELS AND GEAR SIMULTANEOUSLY

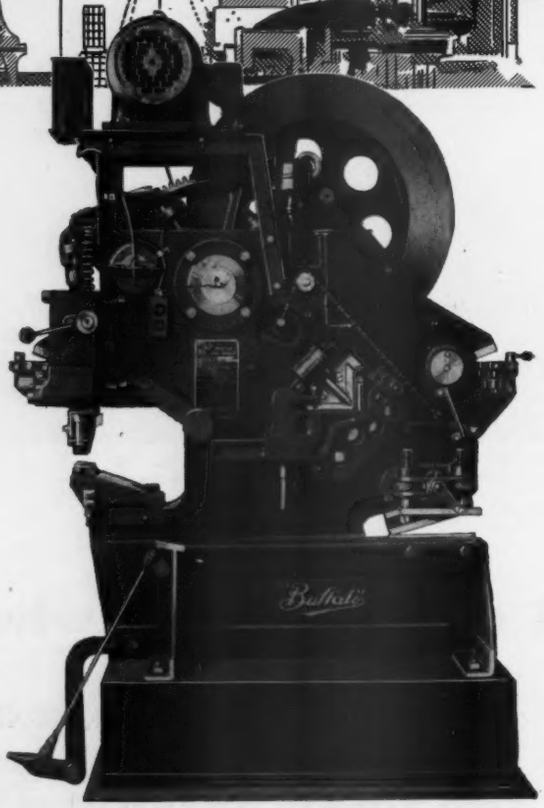
Details in Bulletin 18-L-8

CHAMBERSBURG ENGINEERING CO.

CHAMBERSBURG, PA.

"Buffalo"

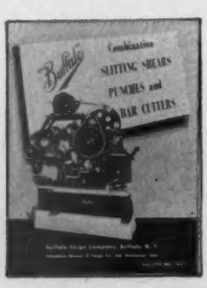
UNIVERSAL
IRON
WORKERS



THAT'S the reputation "Buffalo" Universal Iron Workers have earned in the shops of heavy industry and railway maintenance. Model shown can do FIVE operations without tool changes—THREE, SIMULTANEOUSLY! If you do heavy metal fabrication, you'll do it far cheaper with a "Buffalo" U. I. W.

- NOTCH
- PUNCH
- 3 SELECTIVE DIAMETERS
- COPE SHEAR OR MITRE ANGLES
- SHEAR ROUNDS & SQUARES
- SLIT PLATE OR SHEAR FLATS

Write for Bulletin 360-D for capacities and models available.



Buffalo Forge Company

174 Mortimer St. Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Washington 6, D. C. All Electro-Motive service activities for railroads in southeastern United States will be directed from this point by *F. H. Albert*, newly appointed regional service manager. Territory served by the new office heretofore has been handled by the New York regional service office. Railroads in the northeastern part of the country continue to be served out of New York, under direction of *W. A. Turner*, former assistant regional service manager, now regional service manager. The new Washington office, and the New York service office, will be under the jurisdiction of *Paul Turner*, Eastern regional at New York.

O. L. Olsen, former regional service manager at New York, has been appointed sales engineer in the Eastern region. *A. J. MacNeal*, former assistant manager of the service department technical section at LaGrange, Ill., has been appointed assistant to Mr. Albert at Washington. *R. B. Johnstone*, former manager of the service department technical section, is assistant to the regional service manager at New York.

R. L. Terrell, general parts manager of the Electro-Motive Division at LaGrange, Ill., has been appointed assistant regional manager, New York region. He is succeeded by *Marvin Anderson*, assistant general parts manager.

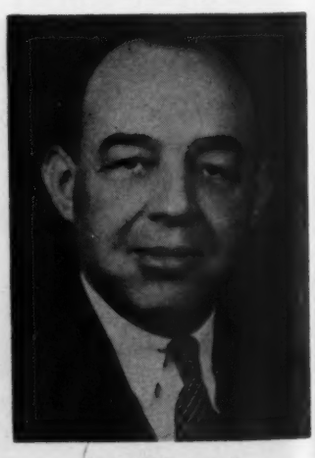
◆

DeVilbiss Company.—The DeVilbiss Company has announced plans for the immediate construction of a new building adjoining the Toledo, Ohio, plant. The increased facilities will provide space for displaying and demonstrating the company's products in actual operation and also provide for an expansion of the customer training school of spray-painting equipment.

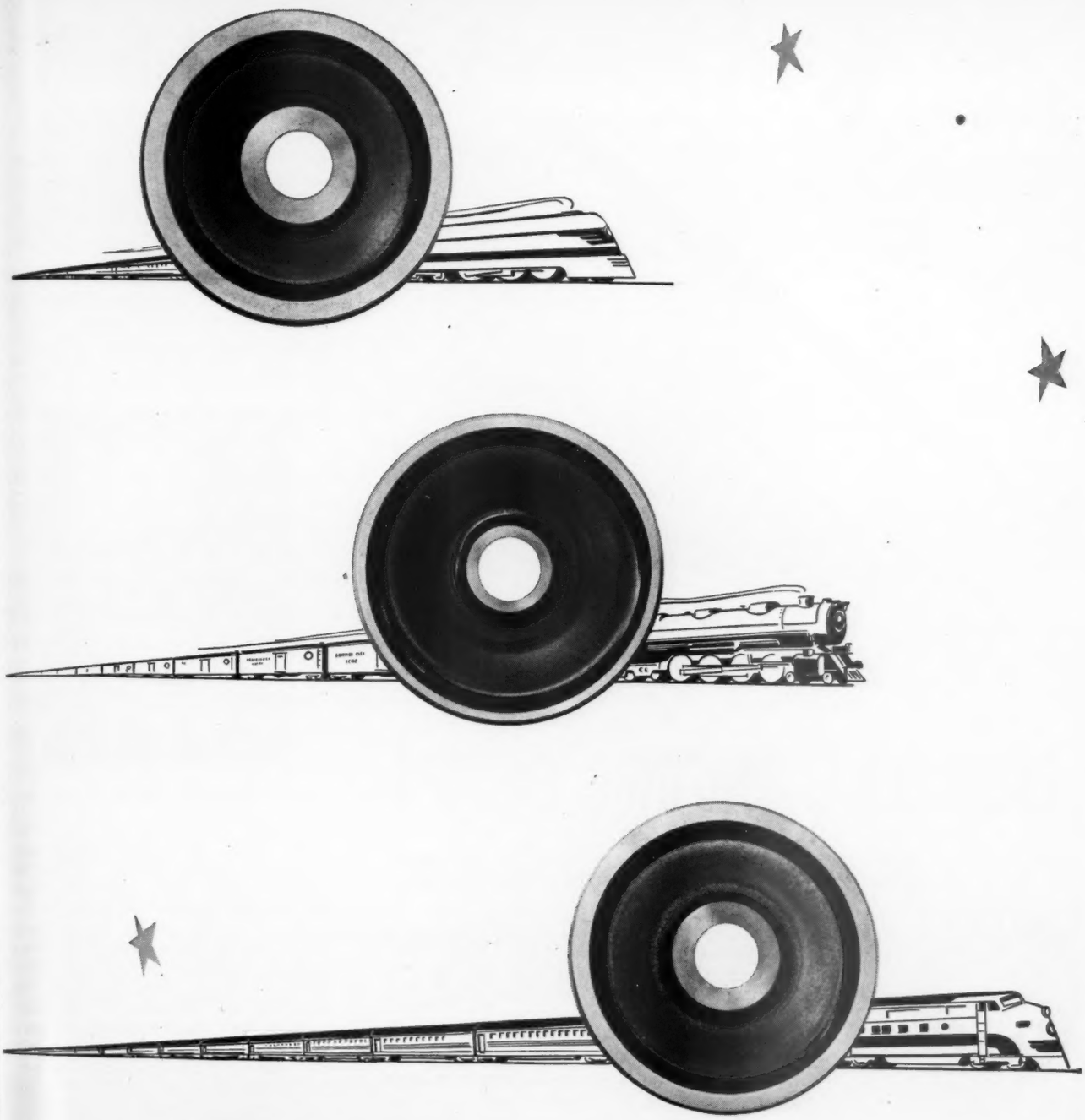
◆

Duff-Norton Manufacturing Company.—*Charles R. Ellicott, Jr.*, has been appointed eastern district sales manager, with headquarters in New York.

Mr. Ellicott, who is a graduate of Lafayette College and a member of the American Society of Mechanical Engineers, formerly held sales engineering positions with the Westinghouse Electric Corporation and the Symington-Gould Corporation. During World War II he served in the U. S. Navy as a Lieutenant



C. R. Ellicott, Jr.



Bethlehem has never been satisfied to make a wheel that is merely "good."

Whether for passenger cars, freight cars, steam or diesel locomotives, the Bethlehem wheels you buy are a blend of the highest technical skills and the best materials it is possible to develop. There are no finer available anywhere—simply because we insist on producing a wheel that is better than good.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM WROUGHT-STEEL WHEELS

PASSENGER • FREIGHT • DIESEL

EXCELLENT, UNIFORM CRIMPS

no matter who installs them

AMP "SELF INSPECTING" HAND AND POWER TOOLS

U.S. Pat. Pending

AMP CERTI-CRIMP (trade-mark) hand tools will not open their jaws unless a completed crimp has been made! Here is *extra* assurance that each wire terminal will be installed with care and precision—WITH MINIMUM OPPORTUNITY FOR HUMAN ERROR!

AMP PRE-INSULATED DIAMOND GRIP (Trade-Mark) SOLDERLESS TERMINALS

U.S. Patents #2,379,567; 2,405,111; 2,410,321; 2,468,169

Designed for STRENGTH, RUGGED DUTY and MAXIMUM VIBRATION RESISTANCE. These terminals are already insulated! Install them with one quick stroke of a tool. Insulation extends far enough to give support to the wire and prevents weakness from bending or fraying. Color-coded for each wire size range from #22 to 10.

AMP Trade-Mark Reg. U. S. Pat. Off.

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AIRCRAFT-MARINE PRODUCTS INC.
1314 N. Fourth St.
Harrisburg, Penna.

Commander, Chief of Diesel Engineering Section, Shipbuilding Division of the W.P.B.

◆

FAIRBANKS, MORSE & CO.—*Robert H. Morse, Jr.*, vice-president in charge of operations, Fairbanks, Morse & Co., at Chicago, has been elected president, succeeding his father, *Col. Robert H. Morse*, who is now chairman of the board. *O. O. Lewis* has been elected vice-president in charge of sales and a director.

Robert H. Morse, Jr., was born on March 10, 1899, and was educated at Notre Dame and Harvard Universities. He started his career with Fairbanks, Morse in 1916 in the foundry of the

Robert H. Morse, Jr.

Beloit, Wis., plant, and subsequently served as assistant manager of the Indianapolis, Ind., works until 1928, except for 18 months spent in the American Expeditionary Forces during World War I. In 1928 he became assistant to president of the Central & South Western Utilities Company, Dallas, Tex., and from 1930 to 1932, was vice-president and treasurer of the Inland Utilities Company, Kansas City, Mo. Mr. Morse later held the positions of branch manager for Fairbanks, Morse at Cincinnati, Ohio, and Dallas until his appointment as manager of the stoker division in 1938. The following year he was transferred to Boston, Mass., as branch manager. He became assistant general sales manager at Chicago in 1942; vice-president and general sales manager in 1943, and subsequently vice-president in charge of operations.

Col. Robert H. Morse was born in Chicago on December 6, 1878. He received his education at Shattuck School, Faribault, Minn., and Hill School, Pottstown, Pa. He began his career in 1895 as an apprentice at the Beloit plant of Fairbanks-Morse Manufacturing Company (now Fairbanks, Morse & Co.). From 1897 to 1900, he was associated with Patterson, Goldfield & Hunter, New York. In 1901 he was appointed assistant manager of Fairbanks, Morse at Cleveland, Ohio, and in 1903 became sales manager of the company's Chicago branch. He was appointed first vice-president in 1924 and three years later became vice-chairman. In 1931 was elected president and general manager.

How to repair damaged freight cars

By A. T. COX, *Vice President*
Lincoln Electric Railway Sales Co., Cleveland, Ohio

AN eastern class I railroad with many all-welded box cars has developed an effective procedure for their repair as illustrated here.

The side-swiped car shown in Fig. 1 will be relatively simple. Bent side posts will be cut out and straightened or replaced. Torn sheet will be replaced with new welded sections. The door will be replaced.

The car nearing completion in Fig. 2 was more severely damaged. The bottom sections of both ends were renewed. About half of the side sheeting had to be replaced with 10 gauge sheet, sheared to width and butt welded together, against side posts . . . also tack welded inside to both sides of posts as shown in Fig. 3. New side posts are standard AAR Z bars. The car also required two new doors. The roof was not damaged.

A new center sill section for this car, shown in Fig. 4, consists of a new shop-fabricated end, spliced in with an AAR welded center sill splice.

Fig. 1. *Damaged box car, ready for welding repair.*

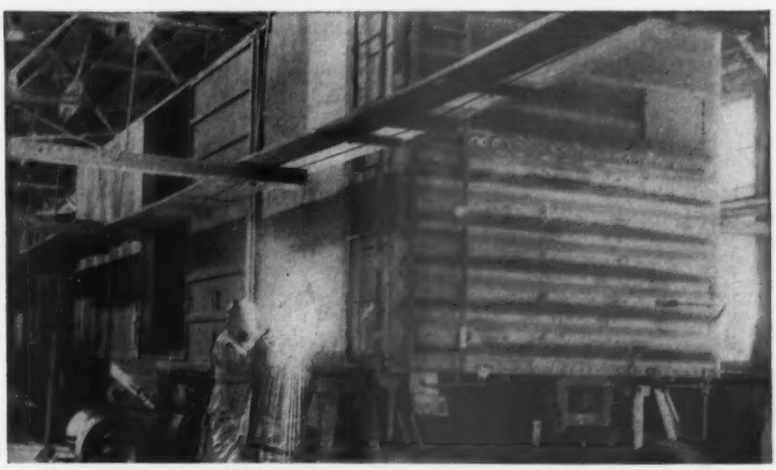


Fig. 2. *Welding repairs on severely damaged car nearing completion. All welding with "Shield-Arc" welder and "Fleetweld 5" electrode.*

Fig. 3. *Inside view showing spliced sheets and new side posts.*

Fig. 4. *Four-foot long end of this center sill was weld-fabricated by the car shop.*

GET THE FACTS

Write for free copy of Welding Design Chart
THE LINCOLN ELECTRIC COMPANY
Dept. 382, Cleveland 1, Ohio

Sales Offices and Field Service Shops in All Principal Cities

LINCOLN

KOPPERS COMPANY.—*H. R. Condon*, a vice-president in the Wood Preserving division of the Koppers Company since 1929, has been appointed vice-president and general manager of the division, succeeding *W. F. Munnikhuysen*, who has been appointed executive vice-president of the company. *Walter P. Arnold* has been appointed executive assistant to Mr. Condon, and *Frank H. Fischer* has been appointed assistant general manager. Mr. Arnold will retain responsibility for railroad sales. Mr. Fischer, Pittsburgh district manager, succeeds Mr. Condon as manager of division activities in the east.

LOCOMOTIVE FINISHED MATERIAL COMPANY.—*A. H. Moorhead*, sales manager of the Locomotive Finished Material Company at Atchison, Kan., has been appointed vice-president in charge of sales. *Harry C. Gunetti* has assumed the duties of works manager. Mr. Gunetti was formerly vice-president and general manager of the Joshua Hendy Corporation.

◆

NATIONAL MALLEABLE & STEEL CASTINGS CO.—*George F. Wilhelmy* has been appointed sales manager, Railway division, Cleveland, Ohio, of the National Malleable & Steel Castings Co., to succeed *George R. Farrell*, who has retired after 43 years of service with the company. *Donald F. Kittredge* succeeds Mr. Wilhelmy as assistant sales manager of the division. *Robert D. Sowers* has been appointed assistant sales manager of the division at Chicago, to succeed *Frank E. Moffett*, who has retired after 41 years' service with the firm.

Mr. Wilhelmy joined National Malleable in 1905 in Cleveland. Four years later he was transferred to New York.

George F. Wilhelmy

In 1919, he returned to Cleveland and served in various capacities until his appointment as assistant sales manager.

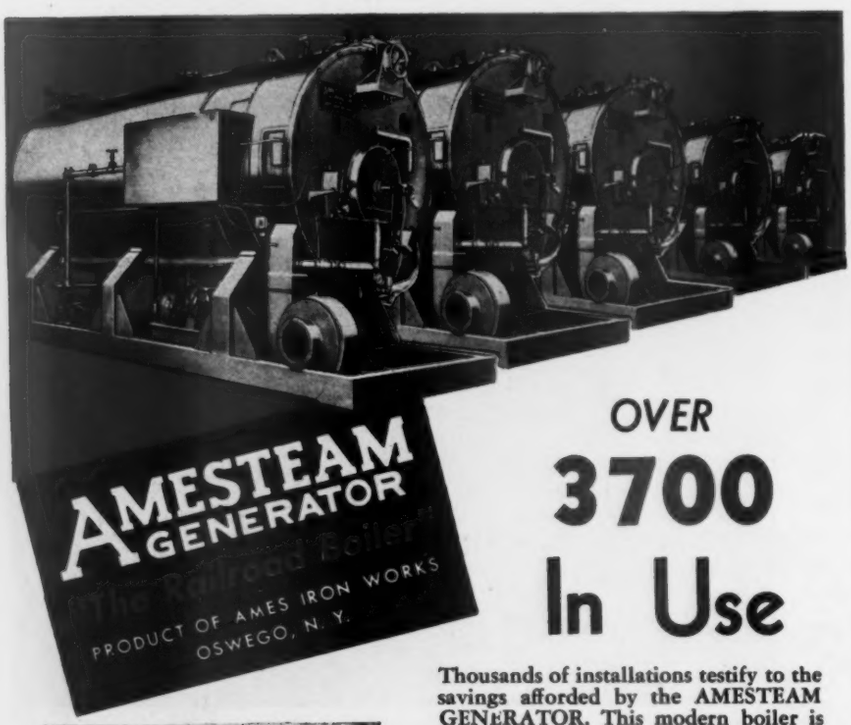
Mr. Farrell joined the company in Cleveland in 1907 and served in the test

George R. Farrell

and inspection department until 1922 when he was transferred to sales and became sales manager of the Railway division at Cleveland.

◆

RAILROAD SUPPLY & EQUIPMENT, INC.—*W. R. Walsh*, formerly a sales agent at Chicago, has been appointed a sales engineer for the Chicago territory of Railroad Supply & Equipment, Inc., Scranton, Pa. The following, who were formerly associated with the Standard Stoker Company, have also been appointed sales engineers of Railroad Supply & Equipment: *W. T. Capps*, eastern seaboard territory, with headquarters at Baltimore, Md.; *W. P. Chenault*, St. Louis territory, with headquarters at Memphis, Tenn.; *A. E.*



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Thousands of installations testify to the savings afforded by the AMESTEAM GENERATOR. This modern boiler is produced by the Ames Iron Works, builders of quality boilers for more than 100 years. Trouble-free—100% automatic in operation, the AMESTEAM GENERATOR requires no chimney draft, only a simple vent to the atmosphere. This rugged unit provides the fuel-saving advantages of a thermal efficiency of over 80%.

Ideal for low-pressure heat in station or shop, also for high-pressure work for sand drying, Diesel de-icing and a host of other railroad applications.

Single units from 10 to 500 H.P. Higher horsepower available on special order. Suitable for multiple installations. Design pressure—15 to 200 lbs. Higher pressures on order.

Delivered complete ready for service connections—including insulation and jacket. *Phone, write or wire.*

Here's Why

80% Thermal Efficiency
100% automatic
Abolishes boiler room labor
Uses oil or gas fuel or a combination of both
No smoke — no soot
Takes up ⅓ the space of conventional boilers
Suitable for multiple installations
Delivered complete ready for service connections

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Exclusive Distributors to the Railroads
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RAILROAD SUPPLY & EQUIPMENT INC.
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Phone Scranton 7-3301

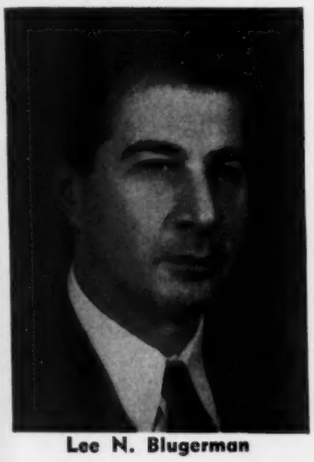
Patterson, Cleveland territory, with headquarters at Cleveland, Ohio; *M. F. Robertson*, southeastern territory, with headquarters at Chattanooga, Tenn., and *E. H. Parr*, northwestern territory, with headquarters at St. Joseph, Mo.

◆

ARMOUR CAR LINES.—*A. V. Nystrom*, superintendent, car department, Chicago, Rock Island & Pacific, resigned on March 1 to become general superintendent of shops of the Armour Car Lines, with headquarters at Chicago. An illustrated sketch of Mr. Nystrom's career was published in the September, 1949, issue, at the time of his appointment as assistant to the general superintendent of motive power of the Rock Island. His appointment as superintendent of the car department was noted in the November issue.

◆

BUDD COMPANY.—*Lee N. Blugerman* has been appointed manager of the Red Lion Plant of the Budd Company. Mr. Blugerman succeeds *Edwin F. Bates* who



Lee N. Blugerman

has been appointed manager of Budd's new automotive plant in Gary, Indiana.

Mr. Blugerman joined Budd in 1936 as an electrical engineer in the Railway Engineering Department. During the construction of the Red Lion plant during the war, he had charge of planning and developing electrical and mechanical facilities. He became plant engineer when the new factory was completed in 1942, and assistant works manager in October, 1946. He has been works manager since January 1, 1949.

Obituary

FREDERICK J. FISCHER, who retired last August as sales representative of the Simmons-Boardman Publishing Corporation, publishers of the *Railway Mechanical and Electrical Engineer* and other transportation papers, died on March 16. He was 60 years old.

◆

E. T. MULCAHY, service representative for the Brandon Equipment Company assigned to the western territory, died recently at Cheyenne, Wyo. Prior to his affiliation with the Brandon company, Mr. Mulcahy represented the American Arch Company in the western territory

RUST-OLEUM

RUST-OLEUM is unequalled for lasting protection against the ravages of rust. It's the practical answer to most railroad rust problems because it can be applied to surfaces already rusted without extensive surface preparation. For 25 years — on major railroads—RUST-OLEUM has proved its capacity to stop and prevent costly rust — on bridges, rolling stock, tanks, metal buildings, metal equipment and other structures.

An exclusive formula, RUST-OLEUM adds years of extra use to all metal surfaces. It cuts maintenance costs — indoors and out. RUST-OLEUM'S tough, pliable film dries to a firm finish that defies rain, snow, salt air, fumes, weathering, etc.

Where rust has already started, RUST-OLEUM can be applied effectively and economically. Scraping and wirebrushing to remove rust scale and dirt is all that is usually required. RUST-OLEUM merges the remaining rust into durable, rust-resisting coating that protects the metal against the elements. Use it in all your maintenance work on all exposed metal. Specify it on all new equipment or structures to be sure of maximum results at the lowest cost, with assurance of the best foundation coat.

Get the facts! . . . Write for complete data and recommended applications. Tell us your rust problems.

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2591 Oakton Street • Evanston, Illinois

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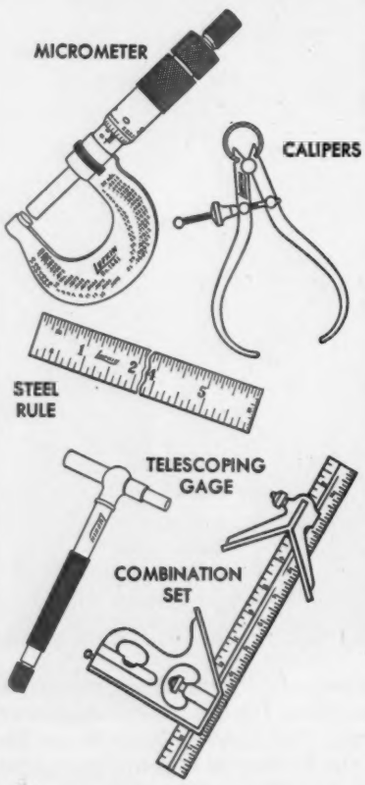
CUT "DOWN" TIME with
LUFKIN Precision Tools!



Accurate, fast measuring with *Lufkin* superior precision tools can speed up repairs . . . reduce the time equipment is "down" . . . increase maintenance efficiency! Every single *Lufkin* tool, several of which are illustrated above, is well designed, sturdily constructed, carefully finished, critically inspected. First with scores of improvements and features, *Lufkin* precision tools find favor with mechanics everywhere. When you need Precision —Buy *Lufkin*. For complete details, write for a copy of *Lufkin* Precision Tool Catalog #7.

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72-E

TAPES • RULES • PRECISION TOOLS
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for 30 years. He began his railroad career with the Union Pacific, his last position with that road being chief clerk in the mechanical department.

◆

RICHARD ARMSTRONG, chief metallurgist of the Pittsburgh Steel Foundry Corporation, Glassport, Pa., died recently.

◆

ALFHONSE I. LIPETZ, retired chief consulting engineer in charge of research for the American Locomotive Company, died on April 11. He was 68 years old.

◆

WALTER H. COYLE, who retired in 1948 as senior vice-president of the Franklin Railway Supply Company, died on April 7, of a heart attack. He was 73 years old.

PERSONAL MENTION

General

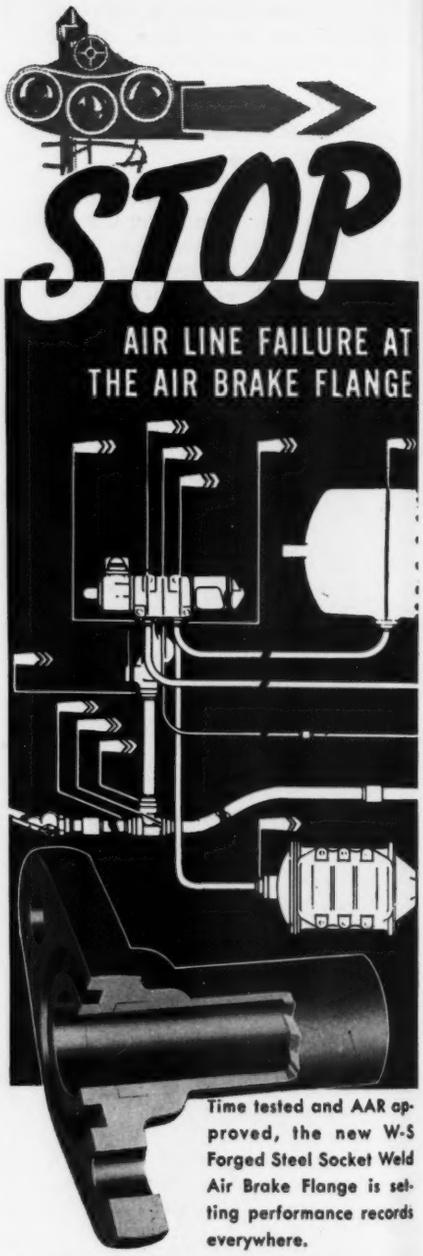
C. R. BUSKARD, superintendent of motive power at the Transcona, Man., shops of the Canadian National, has been appointed assistant works manager of the Point St. Charles shops, Montreal, Que.

E. A. MANETTA, who only recently was appointed assistant foreman, machine shop, at the Portsmouth, Ohio, shops of the Norfolk & Western, has now been appointed personnel assistant—mechanical in the motive-power department of the N. & W.

J. L. SMITH, superintendent of motive power at the Point St. Charles shops of the Canadian National at Montreal, Que., has been transferred to the position of superintendent of motive power at Trancona, Man.

FRANK W. BUNCE, whose appointment as superintendent of motive power, Chicago, Milwaukee, St. Paul & Pacific, at Milwaukee, Wis., was reported in the March issue, was born in Milwaukee on March 9, 1897. He began his career with the Milwaukee in 1914 as a caller and advanced through successive positions at Milwaukee as machinist apprentice, machinist, gang foreman and night enginehouse foreman. Mr. Bunce went to Green Bay, Wis., in 1939 as enginehouse foreman and returned to Milwaukee in 1941 as day enginehouse foreman. During the period from January, 1942 to 1948, he served as enginehouse foreman at Ottumwa, Iowa, enginehouse foreman at Milwaukee; assistant shop superintendent at Milwaukee; assistant shop superintendent at Minneapolis, Minn.; shop superintendent at Minneapolis; division master mechanic at Chicago; and shop superintendent at Milwaukee. He was appointed mechanical superintendent—steam power in October, 1948.

F. J. HARRIS, general inspector of shop methods of the Canadian National at Montreal, Que., has been appointed mechanical engineer (car). Mr. Harris was born at St. Thomas, Ont., and joined the



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One piece drop forged for strength . . . it's lighter in weight, less cumbersome to handle, and is shock resistant.

A W-S representative (listed below) will be glad to explain how safe, efficient and economical it is.

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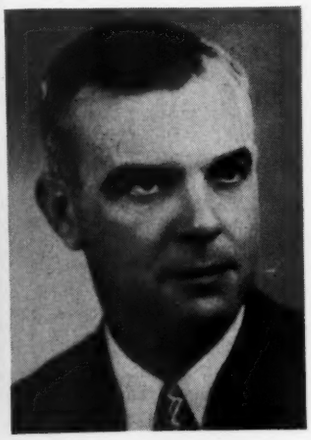
Denver, Colo.	Overgard Machine Tool Co.
New York, N. Y.	Eastern Railway Supplies, Inc.
St. Paul, Minn.	Anderson Machine Tool Co.
San Francisco, Calif.	Overland Supply Co.
Washington, D. C.	Ralph Payne

9-K-11

C.N. as an apprentice in the London, Ont., car shops, where he worked as a carman and cabinet maker from 1934 to

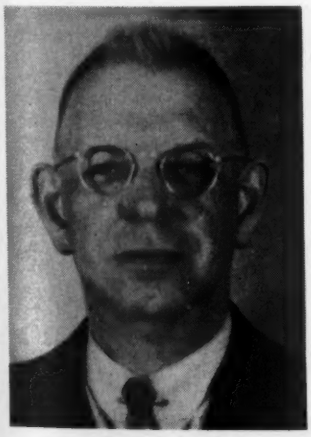


F. J. Harris

1945. He then became apprentice instructor at Leaside shops, Toronto, Ont. He moved to Montreal in 1947 as designing draftsman and became general inspector of shop methods in 1949.

E. L. Jones has been appointed fuel engineer of the Illinois Central, with headquarters at Fulton, Ky.

A. E. Mimms, mechanical engineer of the Canadian Pacific at Montreal, Que., has retired on pension after 32 years of service with the company. Mr. Mimms joined the C.P. at Montreal in 1917, after 17 years of service with the mechanical departments of the Baldwin Locomotive Works, the Atlantic Coast Line, the Erie, the New York Central, the Chicago, Rock Island & Pacific and the Union Pacific. He was appointed assistant engineer on the C.P. in 1920. When that company got into munitions production during World War II, Mr. Mimms was appointed chief engineer in charge of military



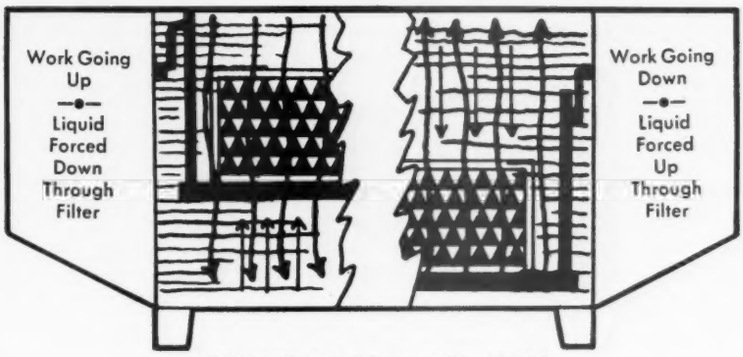
A. E. Mimms

tanks at Angus shops in 1940. A year later he became chief engineer for munitions and in 1945 was appointed chief engineer in charge of inspection for foreign locomotive contracts. Upon completion of this work, he resumed his duties as dynamometer car engineer. For the past two years Mr. Mimms has been mechanical engineer.

S-W-O-O-S-H

YOUR

DIESEL AIR FILTERS CLEAN!



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Push the Button and get 40* Clean Filters in 5 minutes

THE unique up and down motion of the Magnus Aja-Dip Cleaning Machine s-w-o-o-s-h-e-s cleaning solution through the filters 54 times a minute. No wonder they come out in 5 minutes cleaned completely through and through!

You load up to 40* filters in baskets, place them in the machine and push the button. The Aja-Dip Machine does the rest. One man handles the entire job and has plenty of time for other work.

The economies you can obtain with the Magnus Aja-Dip Machine for air filters are even better when you use it for cleaning diesel engine parts. Ask us for complete data on this machine in railroad work.

Investigate Magnus Filter Conditioning Equipment which takes over rinsing, drying and oiling subsequent to the cleaning operation.

*40 small filters 9" x 22" x 2¼" or 20 large filters 20" x 20" x 2¼"

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Electrical

RICHARD E. GALLAGHER, electrical engineer of the Louisville & Nashville at Louisville, Ky., has retired after 26 years of service. Mr. Gallagher attended public schools at Baltimore, Md., and the Baltimore Polytechnic Institute. He served in the electrical department of the Baltimore & Ohio for 10 years, and later engaged in electrical contracting work at Norfolk, Va., and Baltimore. In 1914 he became first assistant electrical engineer for the Seaboard Air Line, in which capacity he served for several years. Subsequently he left the S. A. L. to join the Stone Franklin Company as sales engineer in the Middle West district. In January, 1923, Mr. Gallagher became assistant electrical engineer of the Louisville & Nashville. He was appointed electrical engineer in 1934.

J. LEE PARKER, general foreman of the Atlantic Coast Line at Florence, S.C., has been transferred to the Waycross, Ga., shops as foreman electrical department.

Car Department

A. E. TAYLOR, car foreman of the Canadian National at Toronto, Ont., has been appointed car foreman of the Northern Ontario district, with headquarters at North Bay, Ont.

W. H. RATH, foreman at the Toronto coach yard of the Canadian National, has been appointed car foreman, Toronto Fleet street, with headquarters at Toronto, Ont.

R. D. RICHARDSON, assistant foreman, Toronto coach yard, of the Canadian National, has been appointed car foreman at Stratford, Ont.

Master Mechanics And Road Foremen

W. E. ANDERSON has been appointed assistant master mechanic of the New York Central, Lines West, with headquarters at Chicago. The position of division general car foreman which Mr. Anderson formerly held at Toledo, Ohio, has been abolished.

H. W. RASOR, master mechanic of the New York Central System, Lines West, with headquarters at Chicago, has had his jurisdiction extended over the equipment department, including both the locomotive and car departments on the Toledo-West and Western divisions.

D. B. LACY, boiler foreman of the Atlantic Coast Line, has been appointed master mechanic, with jurisdiction over the Richmond, Norfolk and Wilmington districts, and headquarters at Rocky Mount, N. C.

R. L. PONTON, master mechanic of the Atlantic Coast Line at Rocky Mount, N. C., has been transferred to the position of master mechanic at Florence, S. C., with jurisdiction over the Columbia and Charleston districts.

H. I. PHELPS, master mechanic of the Erie at Meadville, Pa., has been transferred to the position of master mechanic at Marion, Ohio.

FRANK L. BAKER, master mechanic, Western Lines, of the Chicago & North Western at Chadron, Neb., retired on March 31.

J. H. WINFIELD, assistant master mechanic, Iowa division of the Chicago & North Western, Council Bluffs, Iowa, has been appointed master mechanic of the Western Lines, with headquarters at Chadron, Neb.

L. J. GARRETT, master mechanic Central region, of the Pennsylvania at Cleveland, Ohio, has been transferred to the position of master mechanic, Western region, with headquarters at Ft. Wayne, Ind.

J. E. BROWER, master mechanic, Western region, of the Pennsylvania at Fort Wayne, Ind., has been granted a leave of absence.

E. M. VANDIVER has been appointed acting master mechanic, Arkansas division, Missouri Pacific, with headquarters at North Little Rock, Ark., succeeding *George Schepp,* on sick leave.

J. P. DRISCOLL, master mechanic of the Erie at Jersey City, N. J., has been granted a leave of absence.

C. F. SCHWARTZ, shop superintendent of the Erie at Hornell, N. Y., has been appointed master mechanic at Jersey City, N. J.

W. G. CARLSON has been appointed master mechanic of the Erie at Hornell, N. Y.

Shop and Enginehouse

E. BRANNING, master mechanic of the Erie at Hornell, N. Y., has been appointed shop superintendent at Hornell.

F. D. DUNTON, master mechanic of the Erie at Marion, Ohio, has been transferred to the position of master mechanic at Meadville, Pa.

S. E. MUELLER, master mechanic of the Chicago, Rock Island & Pacific at Cedar Rapids, Iowa, has retired after 50 years of service.

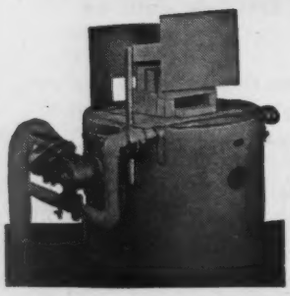
J. W. GANN, general mechanical inspector of the Chicago, Rock Island & Pacific, has been appointed master mechanic at Cedar Rapids, Iowa.

J. H. HAHN, foreman, machine shop, at the Roanoke, Va., shops of the Norfolk & Western, has been appointed general foreman at Bristol, Va.

J. A. GEARHART, assistant machine shop foreman at the Roanoke, Va., shops of the Norfolk & Western, has been appointed foreman of the machine shop.

J. L. KENNEDY, general foreman of the Norfolk & Western at Bristol, Va., retired on March 1.

Full Fire *INSTANTLY*
Without Smoke
...with a JOHNSTON



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